Coolant Distribution Unit (CDU, Chiller)

Jaguar Platform

Thermo Manual P/N U00862
Rev. 03/08/06

Troubleshooting

FRU Replacement

Thermo
ELECTRON CORPORATION

Table of Contents

Preface

After-sale Support 3
Warranty 3

Section I Safety

Warnings 5
EMO Circuit 6
Lockout/Tagout (LOTO) 6

Section II Troubleshooting

Error Code Troubleshooting 7
VFD Faults 20
Monitoring Fluid Loss 22

Section III FRU List

FRU List 23

Section IV FRU Replacement

Electrical Components 40
Control Box Assembly 42
Keypad 43
Dryer Tube 44
Fill Port Screen 45
HFE Filter Bag Kit 46
Pump Inline Dryer 51
Tank Level Switch 52
Pump 53
Temperature Control Valve Assembly 57
Temperature Control Valve Actuator 62
Water Flow Transducer 63
HFE Side Temperature Sensor (rtd1) 64
Pressure Transducers 65
Drip Pan Level Switch Kit 66
Pressure Regulator 67
Plumbing, Pressure Regulator to Temperature Control Valve 69
Plumbing, Facility Inlet Pipe 70
H2O Side Temperature Sensor (rtd2) 71
Return Pipe Assembly, Process Flow 72
Supply Pipe Assembly, Process Flow 74
PRV Cartridge 76
VFD Filter, Contactor, Transformer 77
EMO Thermostat 78
VFD 79
VFD Settings 80
Circuit Breaker 81
Temp Option Board 82
Chip Replacement 83
TC-400 Controller 84

LON Adapter Board 86
Sight Tube Kit 87
Torque Specification Sheet 89
Swagelok Tube Fitting Instructions 90

Section V Controller Loops

Main Loop 93
Engineering Loop 94
Factory Reset 95

Section VI Facility Drawings

873-592-22 96
873-611-00 99

WARRANTY

After-sale Support

Thermo Electron Corporation is committed to customer service both during and after the sale. If you have questions concerning the CDU operation, contact our Sales Department. If your CDU fails to operate properly, or if you have questions concerning spare parts contact our Service Department.

(800) 258-0830

(603) 436-9444

Fax: (603) 436-8411

Before calling, *please* obtain the following information:

- CDU BOM number
- CDU serial number
- CDU software version
- voltage of power source

The CDU's BOM and serial number label are located on the label on the front-top of the CDU. See Service Manual for instructions on how to display the software version.

Warranty

CDUs have a warranty against defective parts and workmanship for 24 months from date of shipment. See back pages for more details.

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Warnings

Make sure you read and understand all instructions and safety precautions listed in this manual before installing or operating your CDU. If you have any questions concerning the operation of your CDU or the information in this manual, contact our Sales Department for assistance.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in serious injury or death. This signal word is limited to the most extreme situations.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Performance of installation, operation, or maintenance procedures other than those described in this manual may result in a hazardous situation and may void the manufacturer's warranty.

Transport the CDU with care. Sudden jolts or drops can damage the CDU.

Do not attempt to defeat any of the interlock switches or safety features built into the CDU.

Observe, and never remove, all warning labels.

Never operate damaged or leaking equipment.

Never operate the CDU without cooling fluid in the fluid reservoir.

Process fluid are subject to environmental regulatory restrictions. Do not dispose into the environment. In the United States use proper OSHA approved location for disposal.

Use remote lockout tag-out procedures prior to servicing the CDU. Make sure the CDU is off before connecting or disconnecting the power cord or other cables.

Always turn off the CDU and disconnect the power cord from the power source before performing any service or maintenance procedures, or before moving the CDU.

Always empty the fluid reservoir before moving the CDU.

Never operate equipment with damaged power cords.

Refer service and repairs to a qualified technician.

EMO Circuit

Each of the following safeties is part of the test system Emergency Off (EMO) circuit. The tripping of either of these safeties will cause power to be dropped to the CDU by the test system. The EMO circuit should not exceed 10A @ 24VDC.

High Air Temperature (TSH-101)
This safety opens the EMO circuit when the air temperature safety switch detects a temperature inside the CDU greater than 70°C. The temperature switch is self-resetting at a temperature of 54°C or below.

Lockout/Tagout (LOTO)

Before performing Chiller maintenance, the energy sources associated with the Chiller system must be lockout and tagged out (LOTO).

Since the CDU itself has no electrical LOTO, lock out power remotely.

Electrical LOTO can be provided by:

Disconnecting main power at the facility power source prior to the system controller cabinet.

The unit does not provide LOTO for the facility water flow. An external user-supplied device is required.

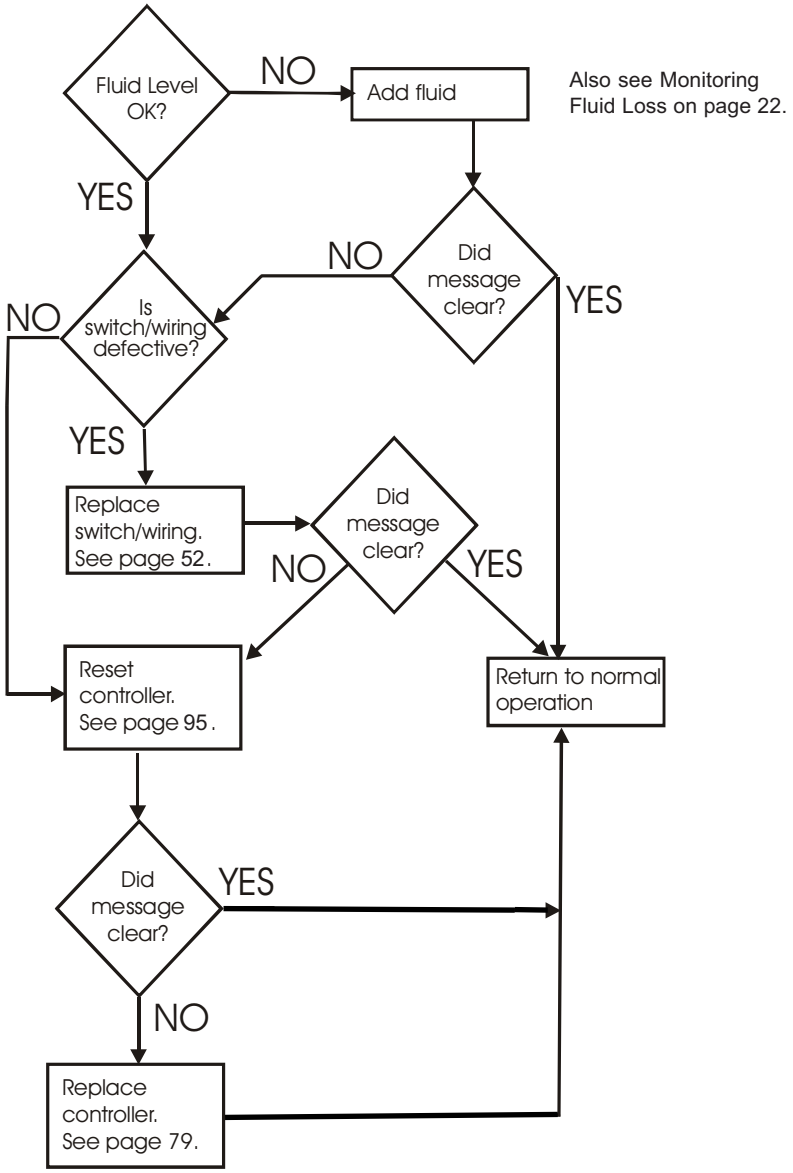
In addition, follow all local facility LOTO directives.

Error Code Troubleshooting

LEVEL WARN
LED

LEVEL WARN
Error Message

Cause:
Upper low level warning switch **closed** for at least 3 seconds.

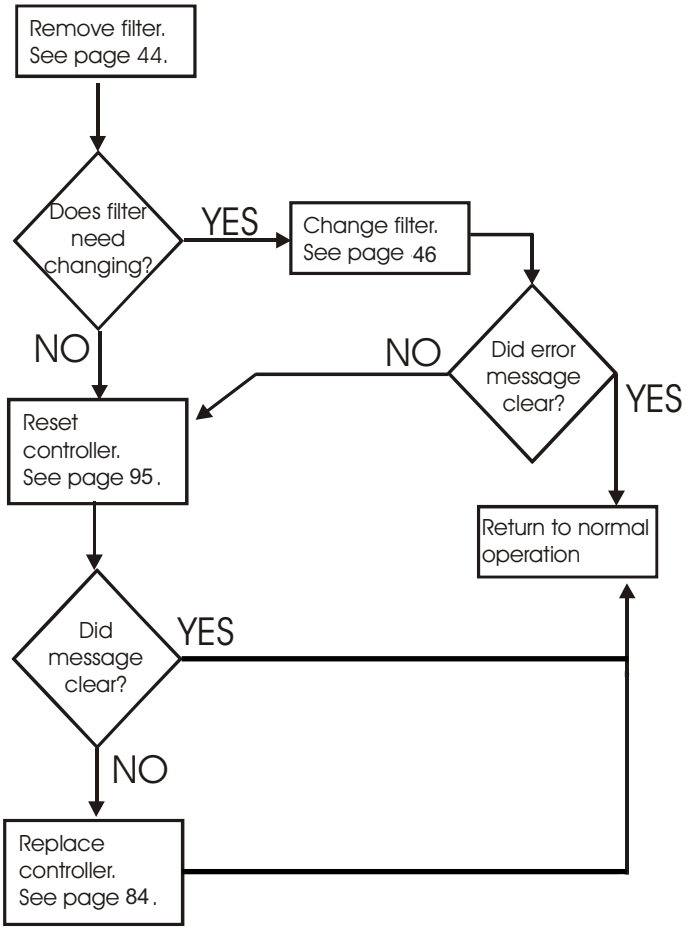


FILTER
LED

CHG FILTER

Error Message

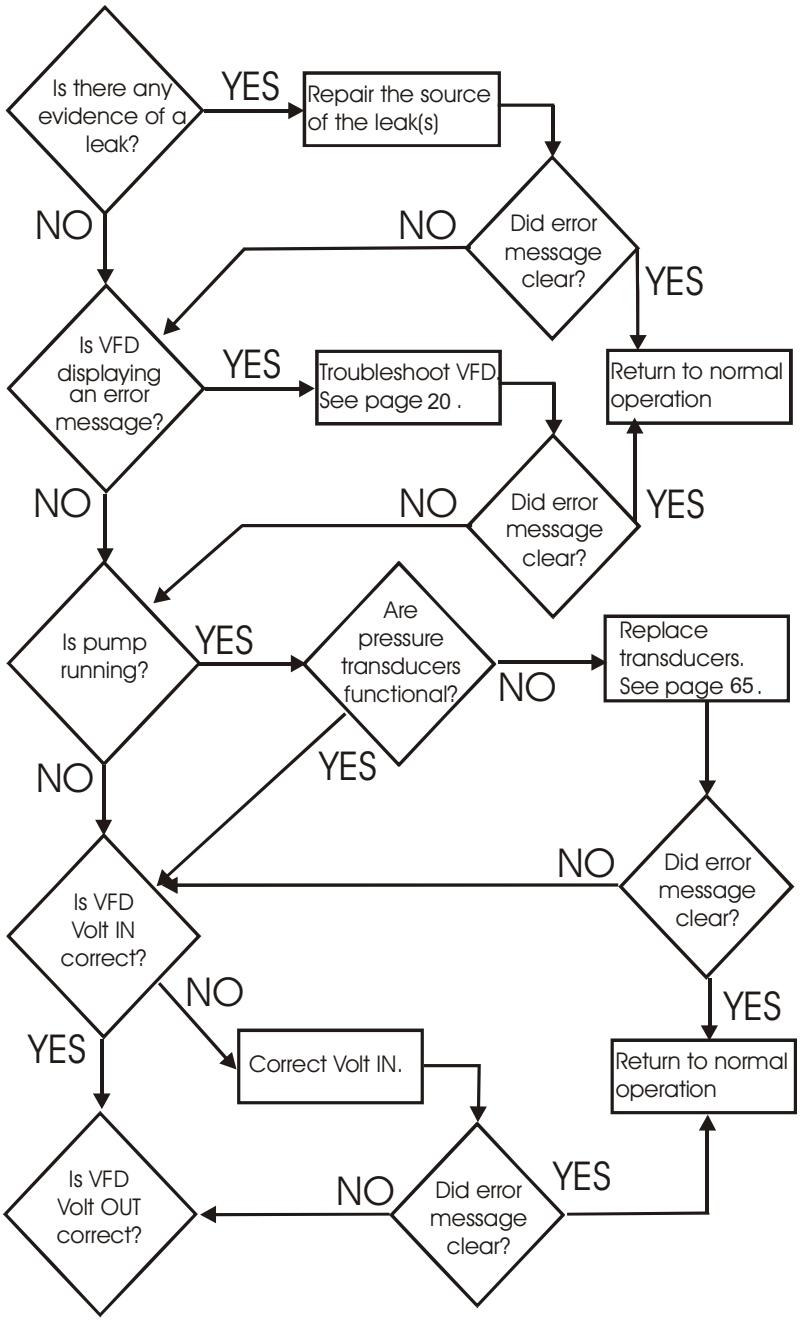
Cause:
Return pressure greater than 10 psi for 1 minute.
NOTE: Normally indicates the filter in the reservoir needs changing.



LOW HFE PRES
LED

LOW PRES
Error Message

Cause:
A major leak has developed or the unit supply pressure less than 20 psi for 30 seconds after pump / VFD start.



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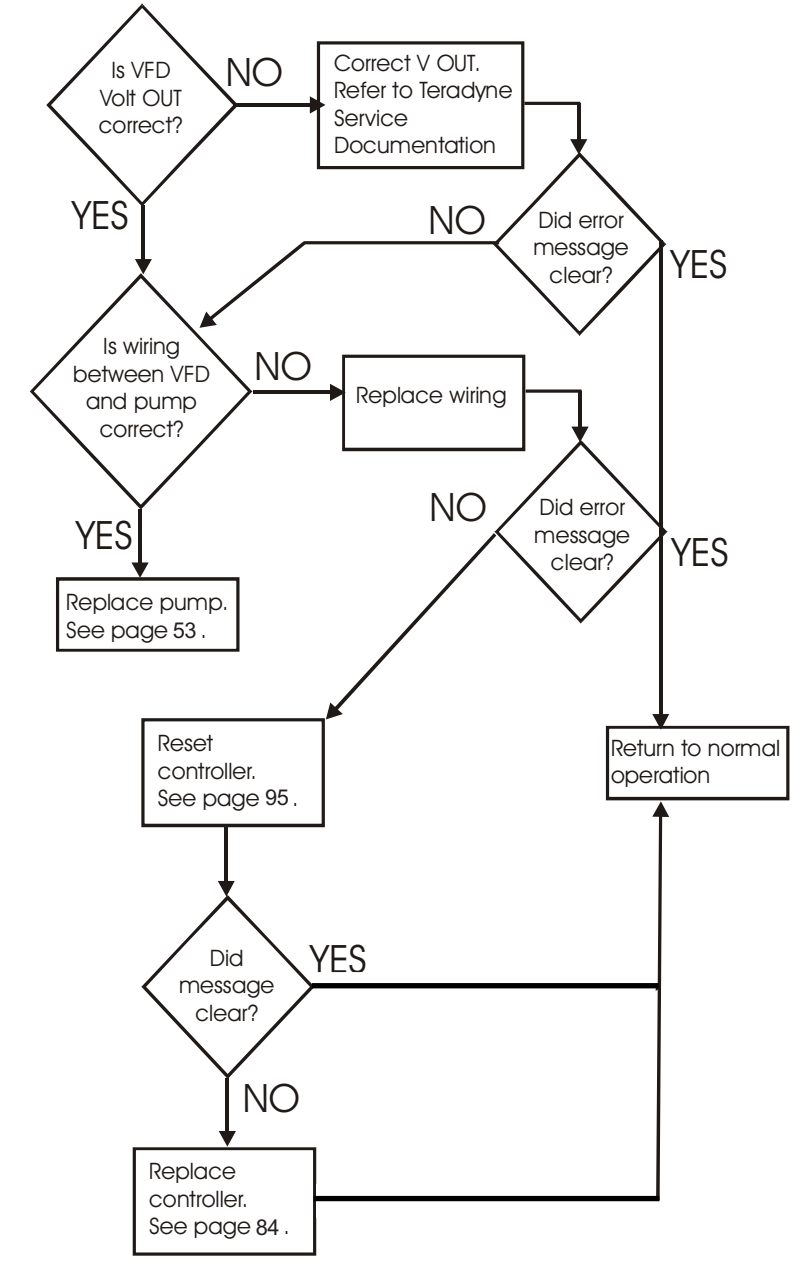
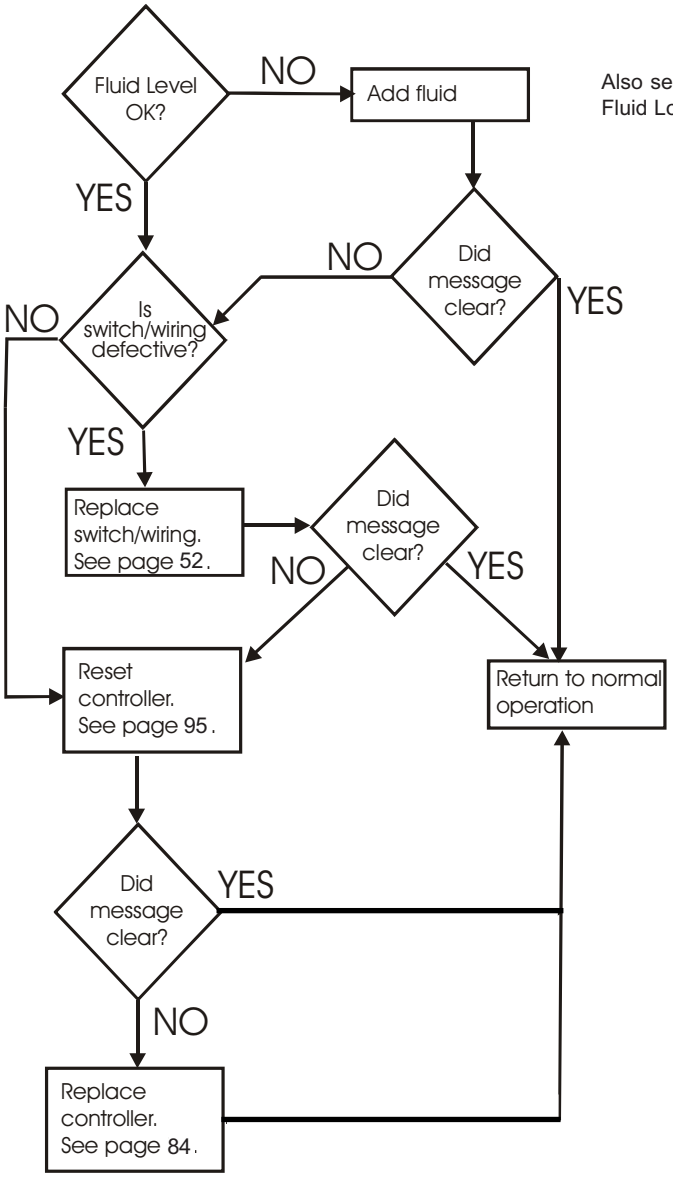


LVL FAULT
LED

LEVEL FAIL

Error Message

Cause:
Lower low level warning switch **open** for at least 3 seconds
NOTE: The LEVEL WARN LED should also be on, if not replace the level switch assembly

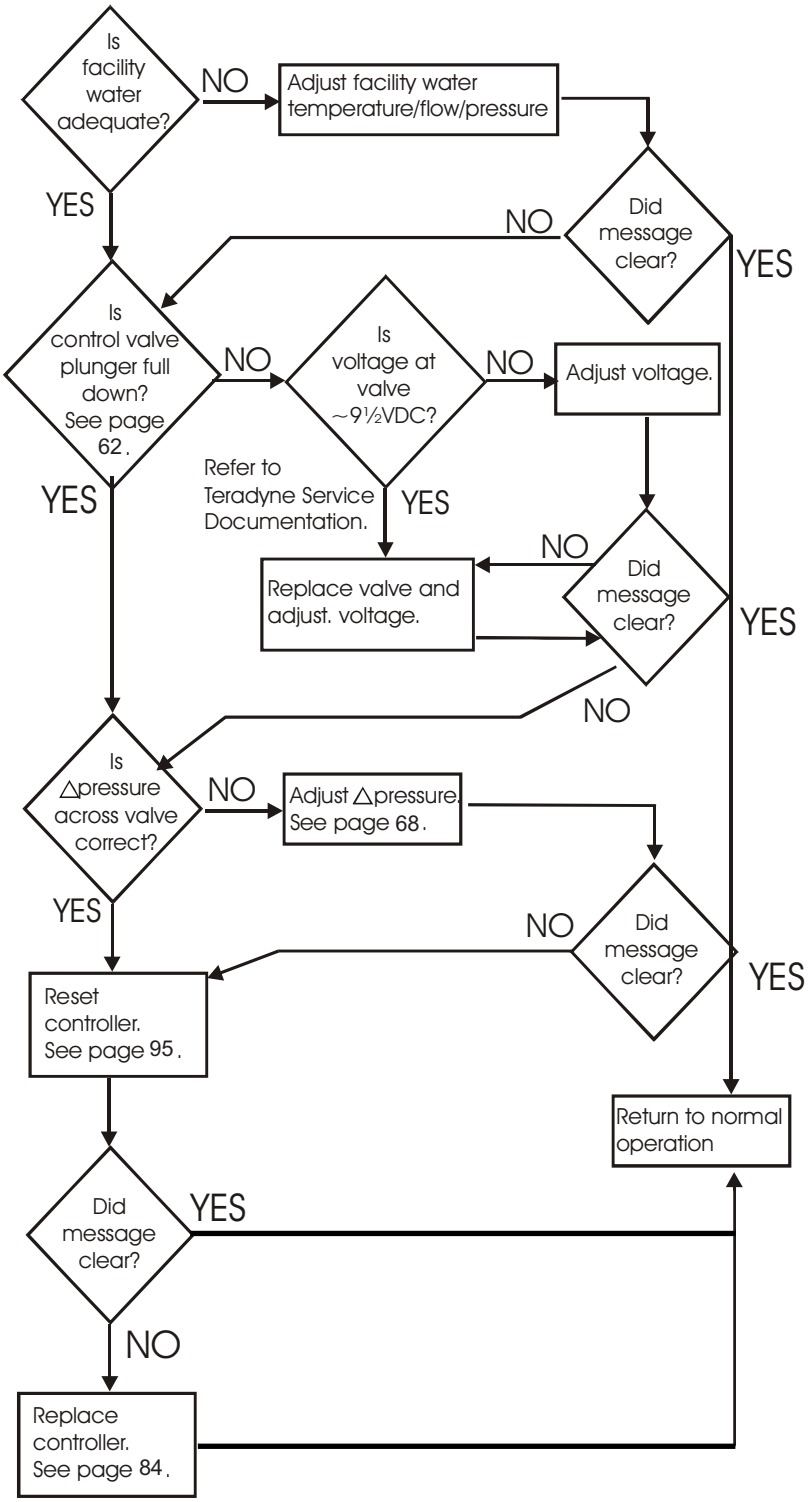


Also see Monitoring Fluid Loss on page 22.

TEMP FAULT
LED

HIGH TEMP
Error Message

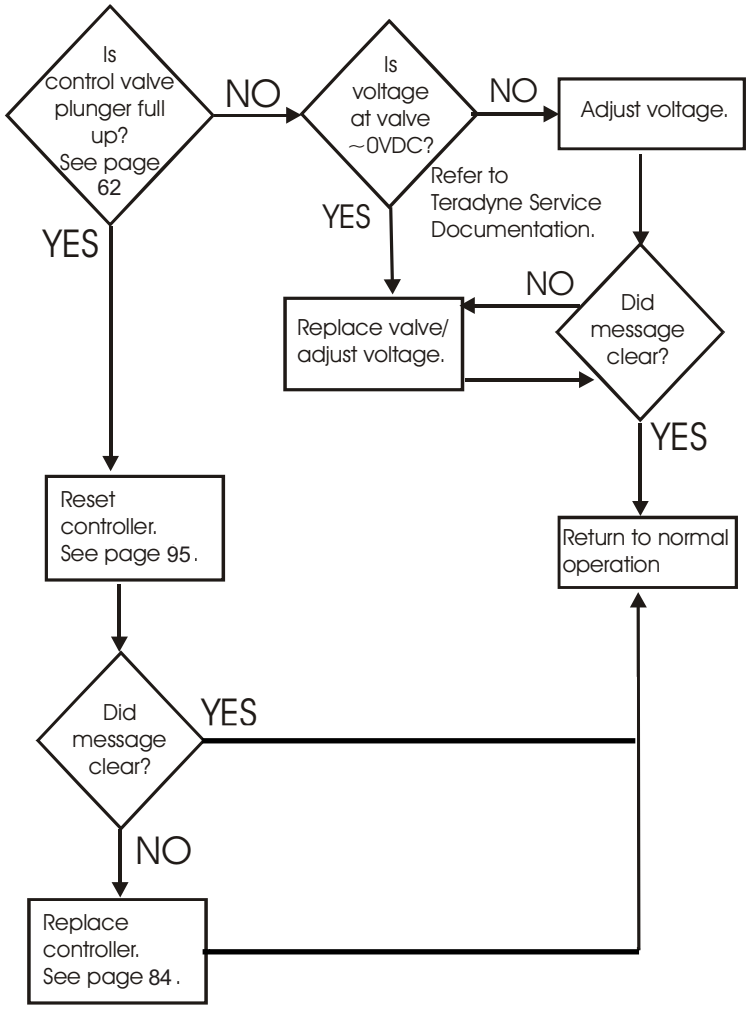
Cause:
Fluid temperature higher than alarm setpoint value in controller's setup loop.
NOTE: This is normally **not** a pump issue



TEMP FAULT
LED

LOW TEMP
Error Message

Cause:
Fluid temperature lower than alarm setpoint value in controller's setup loop.
NOTE: This is normally **not** a pump issue.

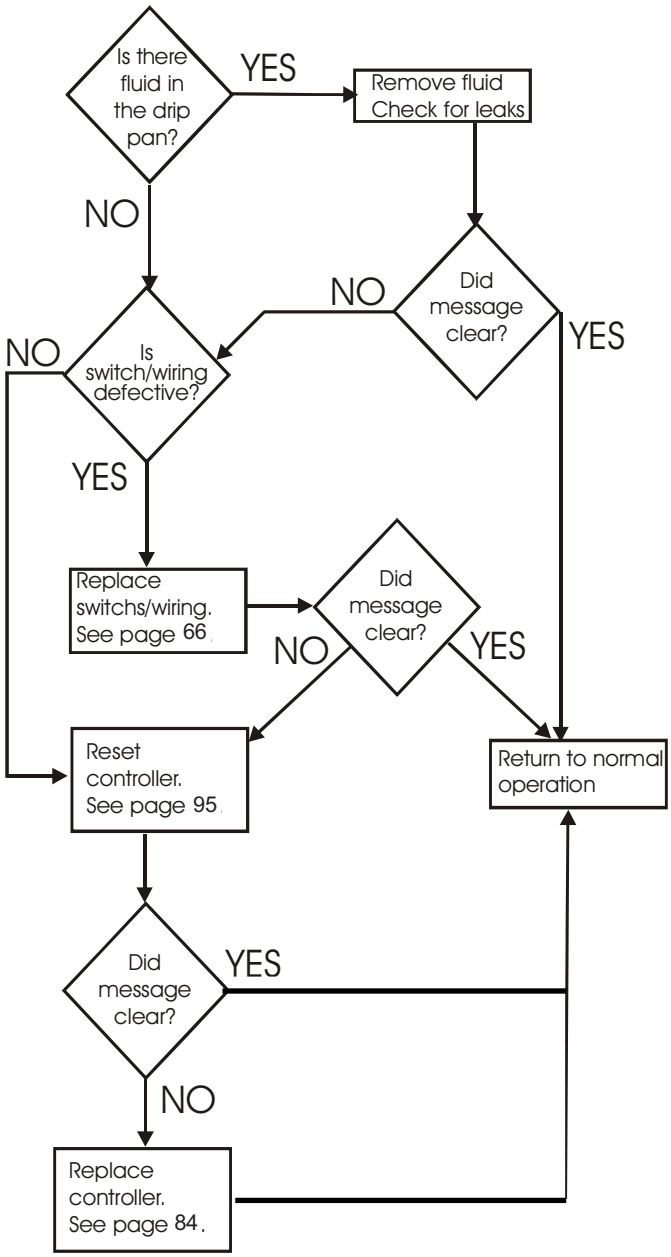


DRIP PAN
LED

DRIP FAULT

Error Message

Cause:
Drip pan level switch is **open.**

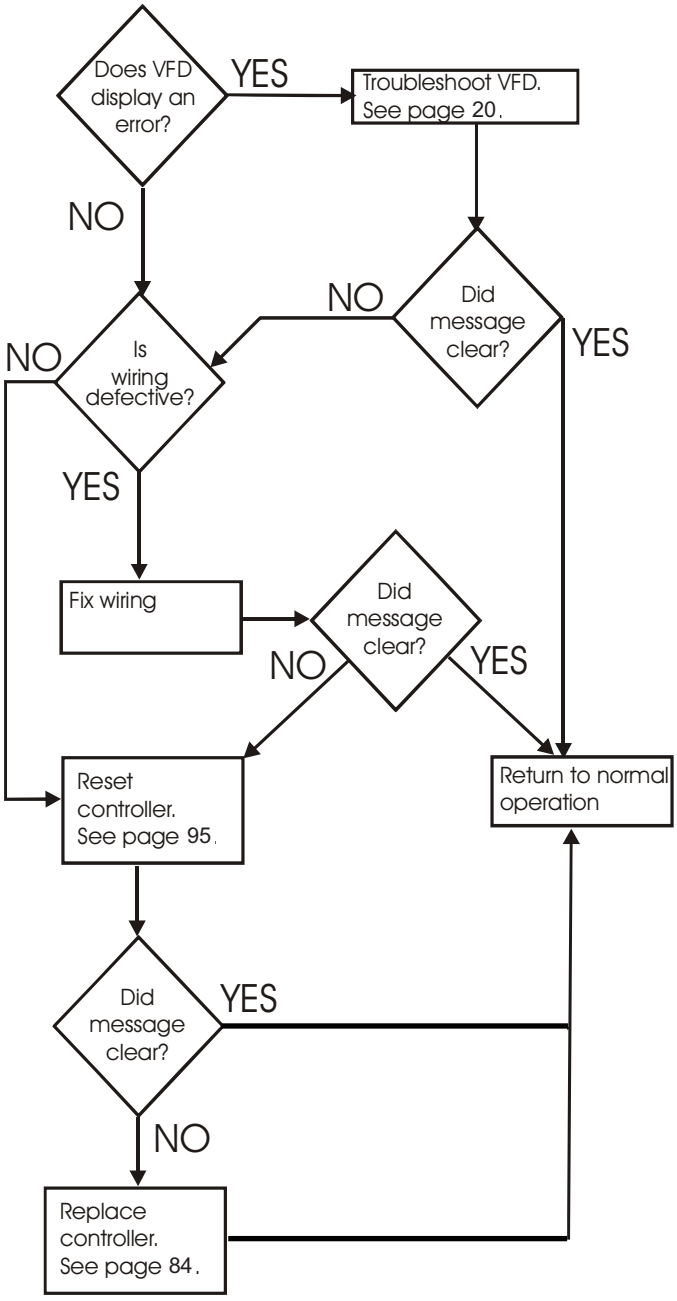


VFD FAULT
LED

VFD FAULT

Error Message

Cause:
Open relay on VFD.



These error messages require checking the applicable sensor and its associated wiring. If the error message does not clear reset and/or replace the controller.

SENSOR FAIL LED

RTD1 FAIL

Error Message

The reservoir fluid temperature probe RTD1 input is open or shorted, see page 84.

PRES 1

Error Message

The coolant return pressure sensor input is out of range, see page 67.

PRES 2

Error Message

The coolant supply pressure sensor input is out of range, see page 67.

HIGH PRES

Error Message

The supply pressure is greater than 110 psi.

NEG PRES

Error Message

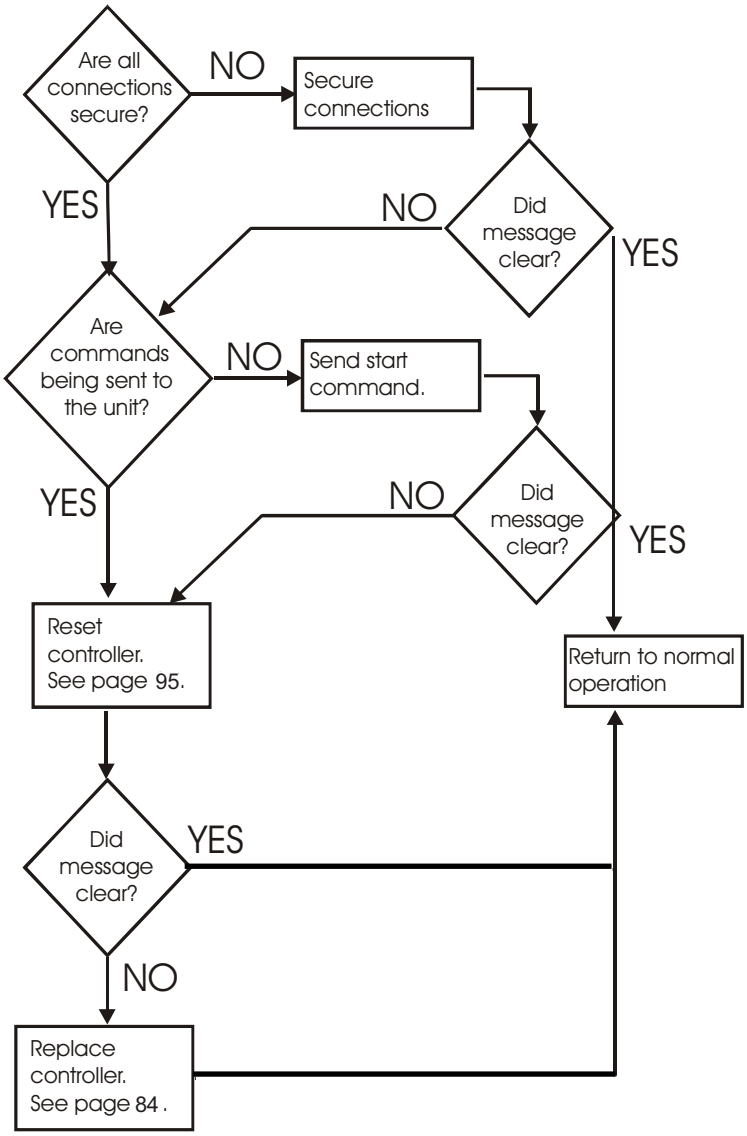
The differential pressure equals a negative value for at least 3 seconds.

COMM DISC ●
LED

COMM DISC

Error Message

Cause:
Communications lost for over 10 seconds while operating in the remote mode.



These error messages require controller chip replacement, see page 83.

Error Message

Error Message

Error Message

Error Message

This error message requires replacing the control board or controller's chip, see pages 83 and 84.

Error Message

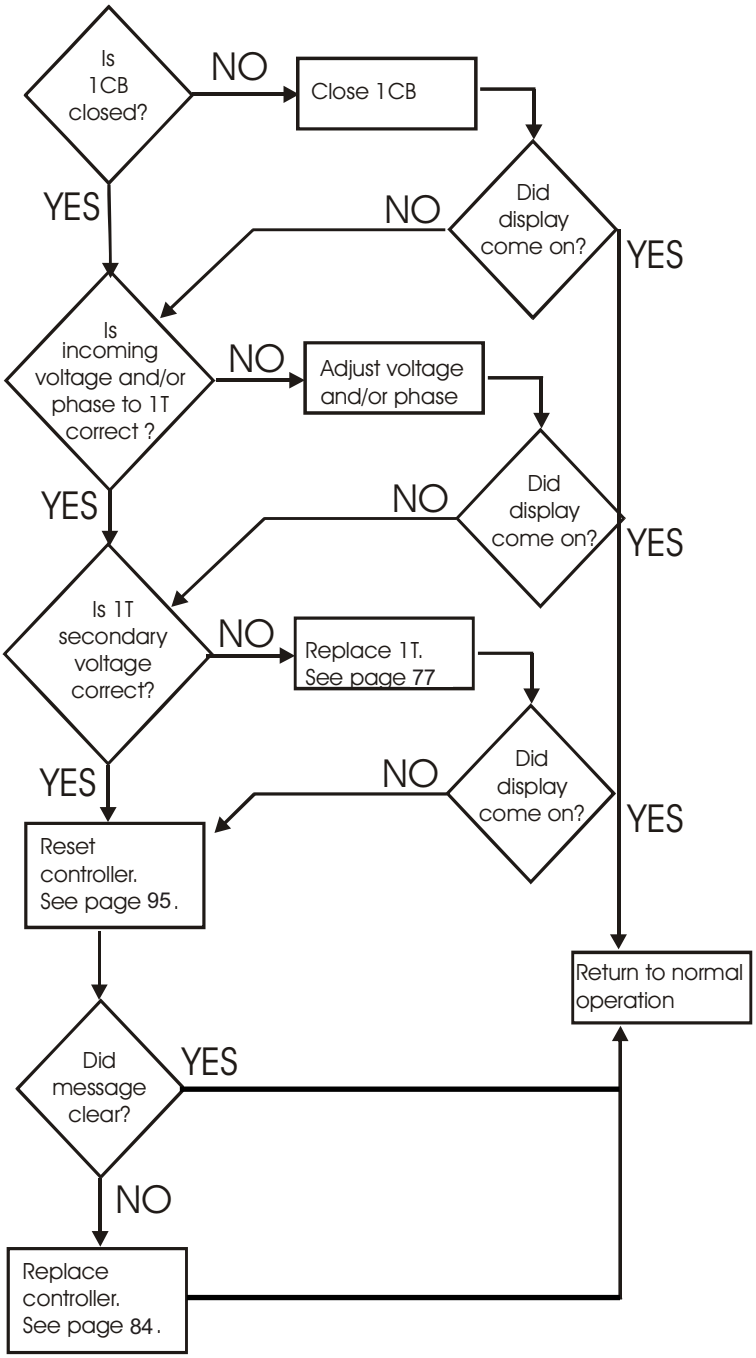
These error messages require checking user software/hardware.

Error Message

Error Message

Error Message

Unit will not start, no error message displayed.



VFD Faults

A fault is a condition that stops the VFD. There are two fault types:

Type 1 - The VFD attempts to automatically reset the fault. If the condition that caused the fault is no longer present, the fault will be reset and the VFD will be restarted.

Type 2- This type of fault may require VFD or motor repair, or is caused by wiring or programing errors. The cause of the fault must be corrected before the fault can be cleared.

For any other fault display contact Thermo.

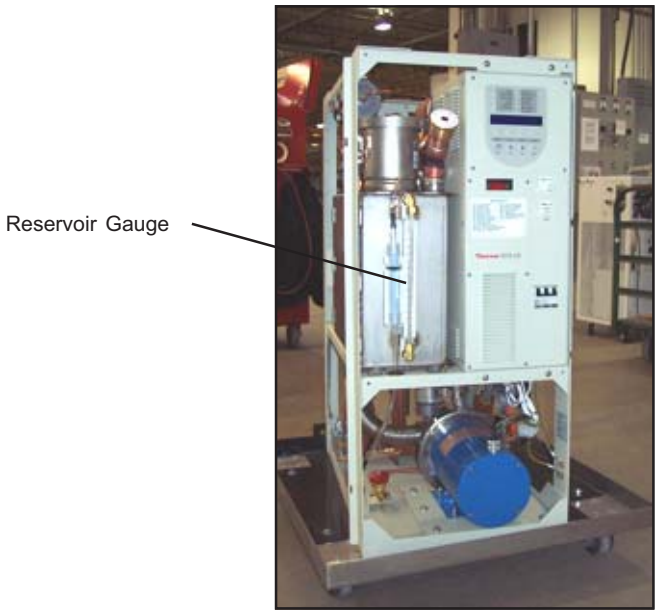
Display	***Fault***	***Type***	***Description***	***Action***
F003	*Power Loss*	*2*	*DC bus voltage remained below 85% of nominal.*	*1. Monitor the incoming AC line for low voltage or line power interruption.* *2. Check input fuses.*
F004	*Under Voltage*	*1*	*DC bus voltage fell below the minimum value.*	*Monitor the incoming AC line for low voltage or line power interruption.*
F005	*Over Voltage*	*1*	*DC bus voltage exceeded maximum value.*	*Monitor the AC line for high line voltage or transient conditions. Bus overvoltage can also be caused by motor regeneration. Extend the decel time or install dynamic brake option.*
F006	*Motor Stalled*	*1*	*Drive is unable to accelerate motor.*	*Check connections on VFD.*
F007	*Motor Overload*	*1*	*Internal electronic overload trip.*	*An excessive motor load exists. Contact Thermo.*
F008	*Heatsink OverTemp*	*1*	*Heatsink temperature exceeds a predefined value.*	*1. Check for blocked or dirty heat sink VFD fins. Verify ambient temperature has not exceeded 50°C(122°F)* *2. Check fan.*
F013	*Ground Fault*	*2*	*A current path to earth ground has been detected at one or more of the drive output terminals.*	*Check the motor and external wiring to the drive output terminals for a grounded condition.*

F038	*Phase U to Ground*	*2*	*A phase to ground fault has been detected between the drive and motor in this phase.*	*1. Check the wiring between the drive and motor.* *2. Check motor for grounded phase.* *3. Replace drive if fault cannot be cleared.*
F039	*Phase V to Ground*		*See F038*	
F040	*Phase W to Ground*		*See F038*	
F041	*Phase UV Short*	*2*	*Excessive current has been detected between these two output terminals.*	*1. Check the motor and drive output terminal wiring for a shorted condition.* *2. Replace drive if fault cannot be cleared.*
F042	*Phase UW Short*		*See F041*	
F043	*Phase VW Short*		*See F041*	
F070	*Power CDU*	*2*	*Failure has been detected in the drive power section.*	*1. Cycle power.* *2. Replace drive if fault cannot be cleared.*
F122	*I/O Board Fail*	*2*	*Failure has been detected in the drive control and I/O section.*	*1. Cycle power.* *2. Replace drive if fault cannot be cleared.*

Monitoring for Fluid Loss

Each line on the Reservoir Gauge represents approximately 1/10 of a gallon. On a routine basis check and record the fluid level. If the fluid level is dropping at a rate faster than indicated by the specification then perform the following:

1. Ensure the Tank Fill Port and the Tank Auxiliary Port Cap are properly installed and on hand tight.
2. Check all sanitary gaskets to insure that they are properly installed and are on according to the Torque Specification Sheet on page 88.
3. Look for signs of a leak at all connections and solder joints.
4. If none of the above yield any results, use a Halogen Leak detector on each connection and joint.
5. Check for leaks at the Test Equipment per your procedures.



Description	Thermo	Teradyne	Thermo	Teradyne
SYS HFE -20CDU	603099991705	873-592-00	603099991706	873-611-00
FRU CDU RETURN PIPE ASSY	093354	360-900-00	093354	390-900-00
FRU CDU FILTER BAG	093355	360-900-01	093355	360-900-01
FRU CDU FILTER O-RING	093385	360-900-02	093385	360-900-02
FRU CDU PUMP W/ GASKETS	093356	360-900-03	093356	360-900-03
FRU CDU PUMP SUCT LINE	093357	360-900-04	093357	360-900-04
FRU CDU INLINE DRIER	093449	360-900-05	093449	360-900-05
FRU CDU SUPPLY PIPE ASSY	093358	360-900-06	**093495**	**360-900-50**
FRU CDU FILL PORT SCREEN	093386	360-900-07	093386	360-900-07
FRU CDU PRESS REGULATOR	093359	360-900-08	093359	360-900-08
FRU CDU FLOW XDUCER	087773	360-900-09	**093493**	**360-900-51**
FRU CDU TEFLON PASTE	093387	360-900-10	093387	360-900-10
FRU CDU FACIL INLET PIPE	093360	360-900-11	**093496**	**360-900-52**
FRU CDU VALVE W/ACTUATOR	093361	360-900-12	**093497**	**360-900-53**
FRU CDU VLV ACTUATOR ONLY	087774	360-900-13	087774	360-900-13
FRU CDU INSUL TAPE	093388	360-900-14	093388	360-900-14
FRU CDU TANK LVL SWITCH	087775	360-900-15	087775	360-900-15
FRU CDU PRESS XDUCER	087782	360-900-16	087782	360-900-16
FRU CDU DRIP PAN SWITCH	087776	360-900-17	**087820**	**360-900-54**
FRU CDU RTD H2O SIDE	087777	360-900-18	087777	360-900-18
FRU CDU DRIER TUBE	093362	360-900-19	093362	360-900-19
FRU CDU RTD HFE SIDE	087778	360-900-20	**087821**	**360-900-55**
FRU CDU FILL PORT CAP	093397	360-900-21	093397	360-900-21
FRU CDU FILL PORT O-RING	093363	360-900-22	093363	360-900-22
FRU CDU PETES PLUG	093384	360-900-23	093384	360-900-23
FRU CDU CIRCUIT BREAKER	087783	360-900-24	087783	360-900-24
FRU CDU CONTACTOR	087784	360-900-25	087784	360-900-25
FRU CDU TRANSFORMER	087779	360-900-26	087779	360-900-26
FRU CDU VAR FREQ DRIVE	087785	360-900-27	087785	360-900-27
FRU CDU LON ADAPT BOARD	087786	360-900-28	087786	360-900-28
FRU CDU TEMP OPTION BRD	087787	360-900-29	087787	360-900-29
FRU CDU VFD FILTER	087780	360-900-30	087780	360-900-30
FRU CDU EMO THERMOSTAT	087788	360-900-31	087788	360-900-31
FRU CDU 1.5" SANIT GASKT	093380	360-900-32	093380	360-900-32
FRU CDU 2" SANIT GASKET	093381	360-900-33	093381	360-900-33
FRU CDU 1.5" SANIT CLMP	093382	360-900-34	093382	360-900-34
FRU CDU 2" SANIT CLMP	093383	360-900-35	093383	360-900-35
FRU CDU TC400 CNTRL BRD	087790	360-900-38	087790	360-900-38
FRU CDU EPROM SOFTWARE	087791	360-900-39	087791	360-900-39
FRU CDU PIPING TO MOD VLV	093448	360-900-40	**093499**	**360-900-59**
FRU PRV CARTRIDGE	015779	360-900-41	015779	360-900-41
FRU KEYPAD	015781	360-900-42	015781	360-900-42
FRU CDU DRIP PAN PLUG	093498	360-900-57	093498	360-900-57
FRU CDU ELECT BOX ASSY	087823	360-900-58	087823	360-900-58
FRU VFD BOX ASSU	N/A	N/A	N/A	N/A
FRU MOTOR OVERLOAD	N/A	N/A	N/A	N/A
FRU SIGHT TUBE KIT	093703	360-966-15	093703	360-966-15

NOTE: If two numbres are listed the second number applies to the 873-611-00 unit.

360-900-09 Transducer,Water Flow
360-900-51

360-900-13 Valve Actuator Only

360-900-15 Tank Level Switch

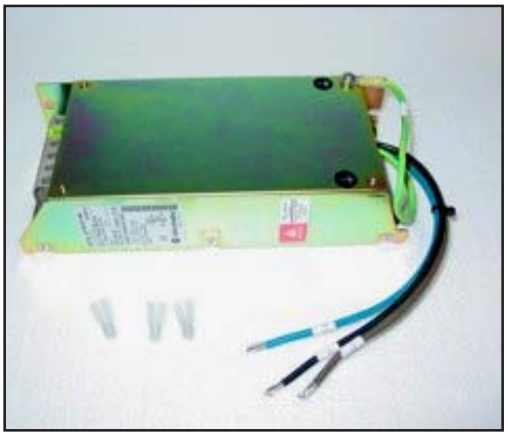
360-900-17 Sensor Kit, Drip Pan Level
360-900-54

360-900-18 RTD H2O Side

360-900-20 RTD HFE Side
360-900-55

360-900-26 Transformer

360-900-30 VFD Filter



360-900-16 Pressure Transducer

360-900-24 Circuit Breaker

360-900-25 Contactor

360-900-27 Var Freq Drive

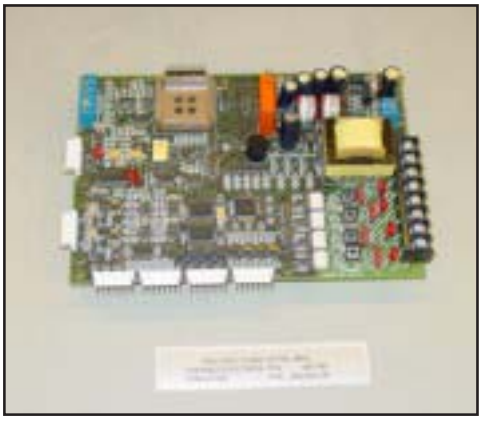
360-900-28 LON Adapter Board

360-900-29 Temp Option Board

360-900-31 EMO Thermostat

360-900-58 Control Box Assembly

360-900-38 TC400 Control Board



360-900-00 Return Pipe Assembly, Process Flow

360-900-01 Filter Bag Kit

360-900-03 Pump with Gaskets

360-900-04 Pump Suction Line, with Gaskets

360-900-06, Supply Pipe Assembly
360-900-50

360-900-08 Pressure Regulator

360-900-11 Facility Inlet Pipe
360-900-52

360-900-12 Valve Assembly, Temperature Control (873-592-00 unit)

360-900-53 Valve Assembly, Temperature Control (873-611-00 unit)

360-900-19 Dryer Tube

360-900-32 Gasket 1½" / 360-900-33 Gasket 2"

360-900-34 Clamp, Sanitary Fitting 1½" / 360-900-35 Clamp, Sanitary Fitting 2"

360-900-23 Petes Plug

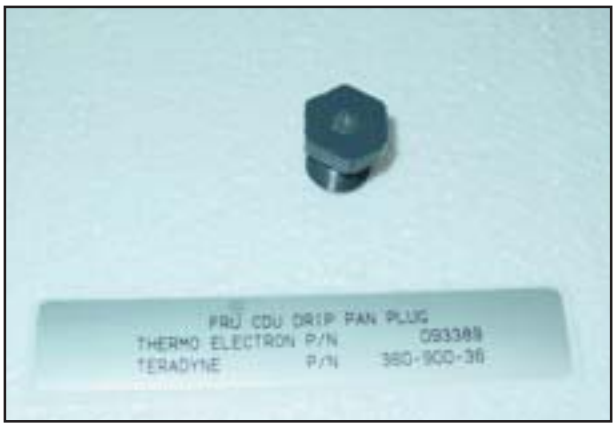
360-900-02 O-ring, Filter Housing

360-900-07 Fill Port Screen

360-900-10 Teflon® Paste

360-900-14 Tape, Insulating

360-900-57 Fitting, Drip Pan Plug



360-900-21 Fill Port Cap

360-900-40 Piping to Mod Valve
360-900-59

360-900-05 Pump Inline Dryer

Programmable Chip Extractor

360-900-42 Keypad

360-900-41 Pressure Relief Valve Cartridge

360-900-22 Service Kit, Fill Port Cap

360-966-15 Sight Tube Kit

CAUTION

For personal safety and equipment reliability, the following procedures should only be performed by a qualified technician. The following steps assume the technician is knowledgable of all Swagelok initial tightening and retightening procedures. Contact our Service Department for assistance.

WARNING

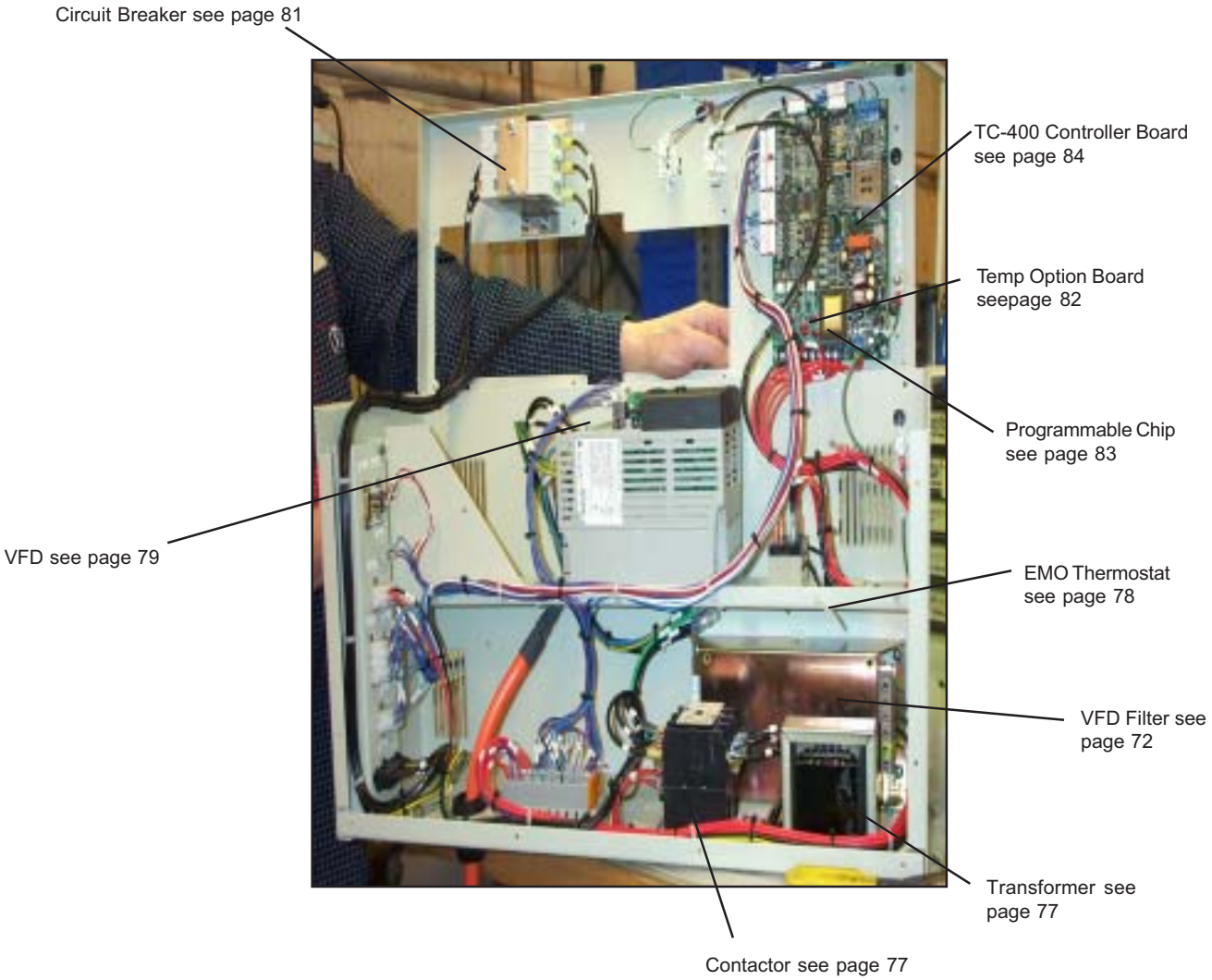
Contact with hazardous voltage inside the chiller can cause severe injury of death. Turn off and Lockout/Tagout (LOTO) power before servicing. Have a qualified technician verify that line voltage is no longer present within the unit after performing a LOTO procedure and before working on system.

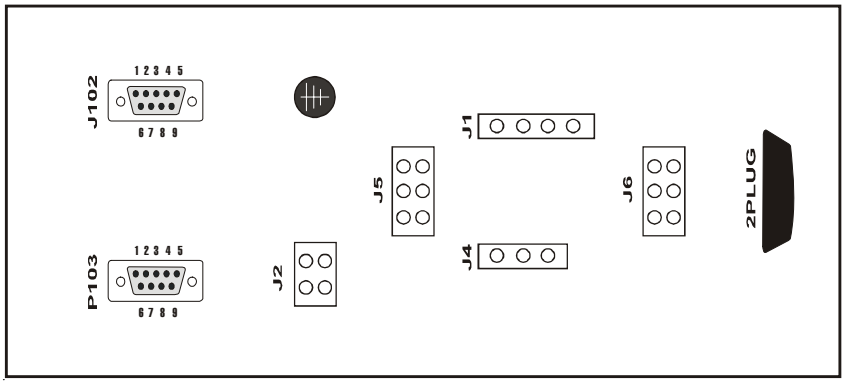
CAUTION

Performance maintenance and service procedures other than those described in this manual may result in a hazardous situation.

Electrical Components

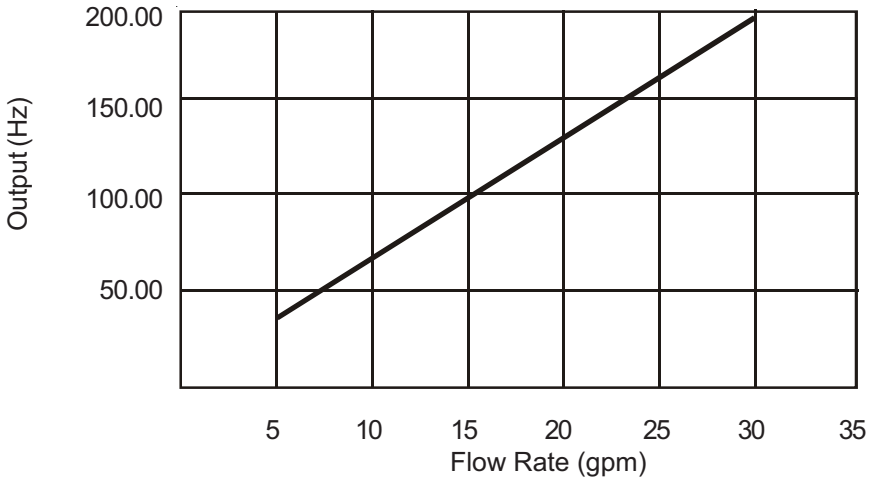
To access any of these electrical components you must remove the control box assembly and the side panel.


Circuit Breaker see page 81
TC-400 Controller Board see page 84
Temp Option Board seepage 82
Programmable Chip see page 83
VFD see page 79
EMO Thermostat see page 78
VFD Filter see page 72
Transformer see page 77
Contactor see page 77



Bottom View (See Next Page)

Device	Connector	Action	Values
Coolant RTD	J102	Check resistance pins 1 and 7	100 Ohms @ 0°C ~110 Ohms @ room temp
Facility RTD	P103	Check resistance pins 1 and 7	100 Ohms @ 0°C ~110 Ohms @ room temp
Level Switches	J1	Check resistance Pins 1 and 2 warning Pins 3 and 4 shut down	0 Ohms = closed ∞Ohms = open
Drip Pan Switch	J2	Check resistance Pins 1 and 2	0 Ohms = closed ∞Ohms = open
Facility Flow Transducer	J4	Check Voltage Pins 1 and 2	See chart below
Motor Valve	J5	Measure Voltage Pins 1 and 2	100% open => 9.5 VDC 0% open = < 6.0 VDC
Pressure Transducers	J6	Measure voltage Pins 2 and 3 supply Pins 5 and 6 return	37.5 psi per volt plus 0.5 volts (example - 150 psi = 4.5 volts)



Control Box Assembly (360-900-58)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
#2 Philips Head Screwdriver

11/32" wrench

Wiring Diagram

Procedure:

1. Using #2 Philips Head, remove the 4 screws securing the control box assembly to the front of the unit.

2. Remove the single screw securing the base of the control box to the unit's mid-frame.
3. Remove the 8 connectors at the bottom of the control box.
4. At the pump motor, remove the wiring running from the base of the control box.
5. Remove the 11/32 nut securing the ground wire at the rear of the unit.
6. Slide the control box assembly out from the unit.
7. To reinstall, reverse the procedure.

Torque Control Box to Mid Pan, Bottom	14 - 16"-lbs
Torque Control Box to Mid Pan, Top	24 - 28"-lbs
Torque Control Box Assembly to Sides	24 - 28"-lbs

8. Rewire according to the wiring diagram.
9. Return the replaced control box assembly to Thermo Electron.

360-900-42 Keypad

Tools Required:
Screwdriver

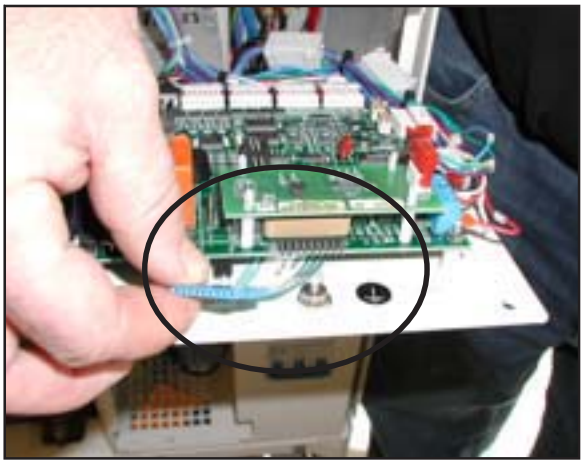
11/32" wrench

Procedure:

1. Remove the 4 screws securing the keypad panel to the front of the unit.

2. Disconect ribbon cable from control board.

3. Remove the 11/32 grounding nut.



4. Peal the keypad off the panel.

5. When reinstalling, tighten gounding nut 14-16"-lbs.

Dryer Tube
(360-900-19)

When the cartridge color-change feature (blue to pink) reaches the bottom of the top cap, the dryer tube needs changing.

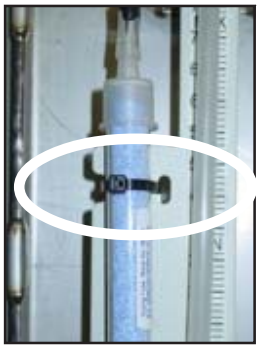
WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
Tywrap cutter/scissors

Procedure:

1. Remove the top and bottom tubes from the dryer tube nipples.

2. Cut the ty-wrap.



3. Reverse the procedure to install a new dryer tube.

4. Once the unit is restarted check for leaks.

Fill Port Screen (360-900-07)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
None

Procedure:

1. Remove the fill port cap by turning counterclockwise.

2. Remove the screen.

3. Replace the screen.

4. Reinstall the fill cap.

5. Once the unit is restarted check for leaks.

HFE Filter Bag Kit (360-900-01)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

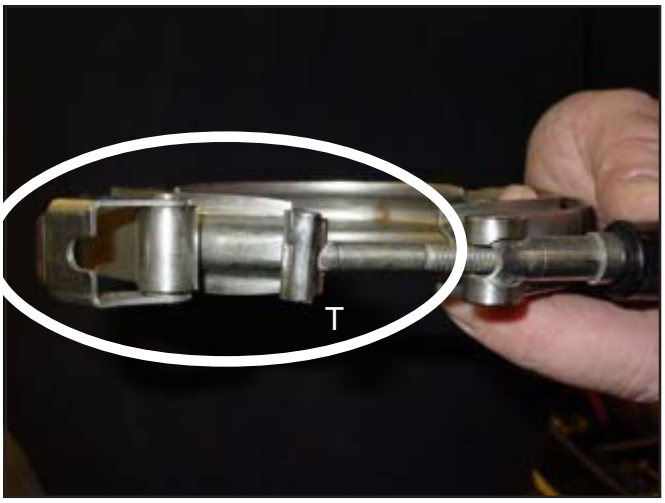
Tools Required:
None

Procedure:

1. Crack open the reservoir fill to allow air into the tank.

2. Locate and then loosen the black knob on the clamp at the top of the filter housing.

3. Remove the clamp. Note how the "T" is locked into position on the clamp.



4. Remove the lid and gasket.

5. Remove the spacer, handle up.

6. Pull out the old bag to remove it.

7. Install a new bag. **Ensure that the paper tag is removed from the bag.**

8. Reinstall the spacer, handle up.

9. Replace the lid gasket and reinsall the lid.

10. To reinstall a new bag push down on the lid and gasket when tightening the black knob. Hand tighten until the gap matches the other two gaps.

11. Once the unit is restarted check for leaks.

12. Ensure the LED and error message on the controller are both extinguished.

Pump Inline Dryer (360-900-05)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
9/16" wrench

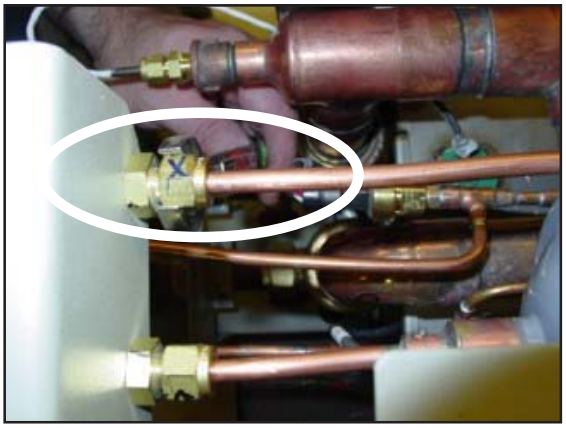
Procedure:

For easier access to the assembly remove the unit from the cabinet.

1. Note orientation of dryer assembly.

2. Crack open the reservoir fill to allow air into the tank.

3. Use the 9/16" wrench to remove the Swageloks securing the dryer assembly to the unit. To make removing the outer Swagelok easier, bend the inner dryer line down to get it out of the way.



Top View

4. Undo the two Velcro straps and remove the dryer assembly.

5. Install a new dryer assembly. Secure the Velcro straps first to prevent bending the lines.

6. Connect the two ¼" lines and tighten the Swageloks per the tightening procedure on page 90.

7. Once the unit is restarted check for leaks.

Tank Level Switch (360-900-15)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

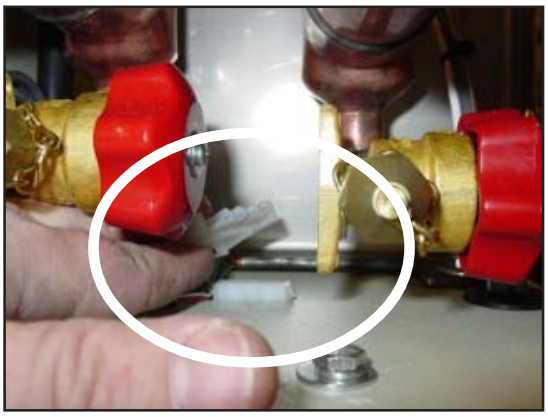
Tools Required:
Adjustable wrench

Tywrap cutter/scissors

Procedure:

1. For easier access to the switch, remove the control box assembly, see page 42.

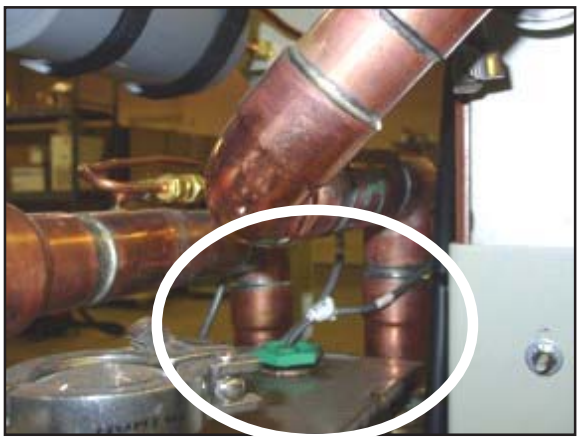
2. Undo the electrical "D" connector on the rear of the unit.



3. Remove the ty wraps.

4. Undo the green plastic fitting and remove the switch assembly from the reservoir.

5. To reinstall a new assembly reverse the procedure. **NOTE:** To prevent cross threading, install the new assembly into the reservoir only hand tight.



6. Once the unit is restarted check for leaks.

7. Ensure the LED and error message on the controller are both extinguished.

Pump (360-900-03)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

CAUTION **Crack the fill cap to relieve any tank/system pressure.**

Tools Required:
11/16" wrench

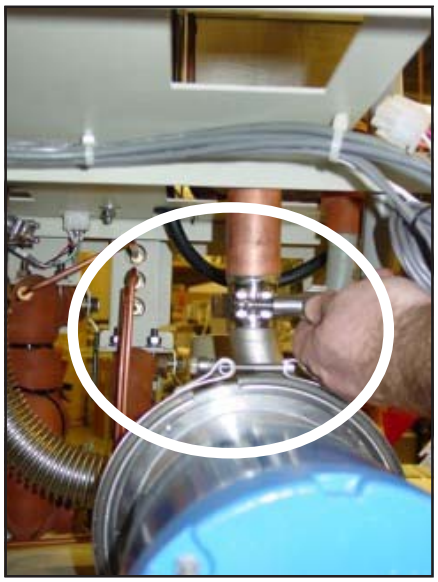
7/16" wrench

1/2" wrenchet.

Procedure:

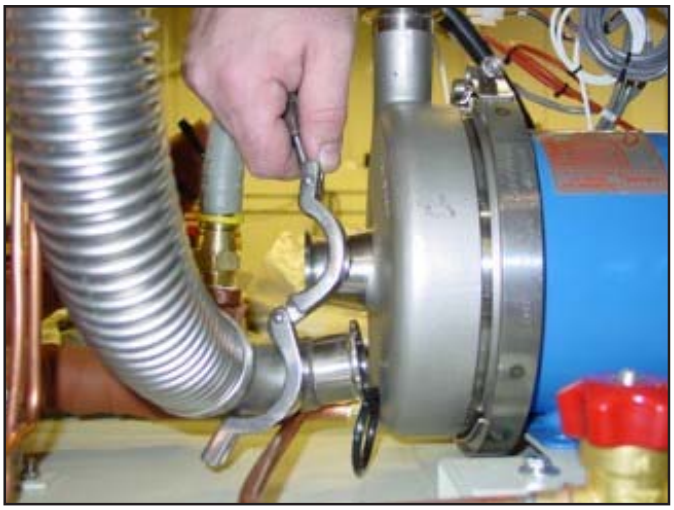
For easier access to the pump remove the unit from the cabin

1. Drain the water. Refer to Teradyne Service Documentation for proper procedure.
2. Remove the control box assembly, see page 42.
3. Remove sanitary clamps from both ends of the elbow running from pump discharge line to the plate exchanger.

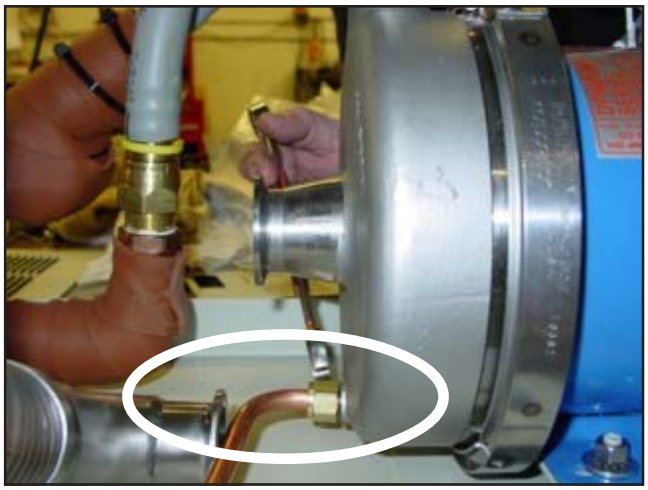


4. Remove the clamps, elbow, and gaskets from the unit.

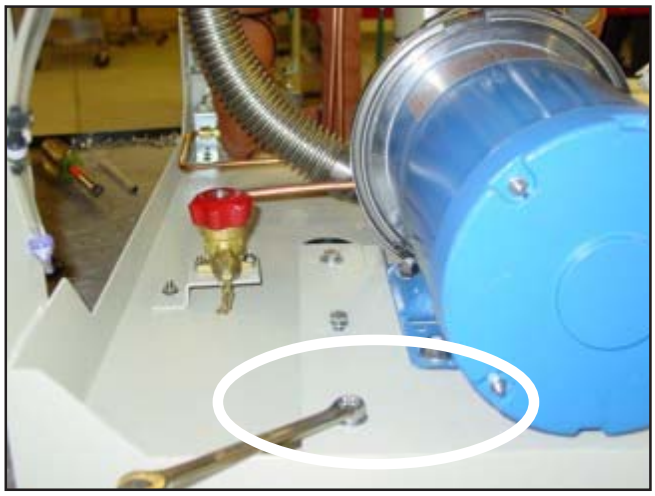
5. Remove the sanitary clamp on the pump's suction line.



6. Using a 11/16" wrench, remove the fitting from the pump's drain line.



7. Using a 7/16" wrench, remove the 6 bolts securing the pump plate to the unit.



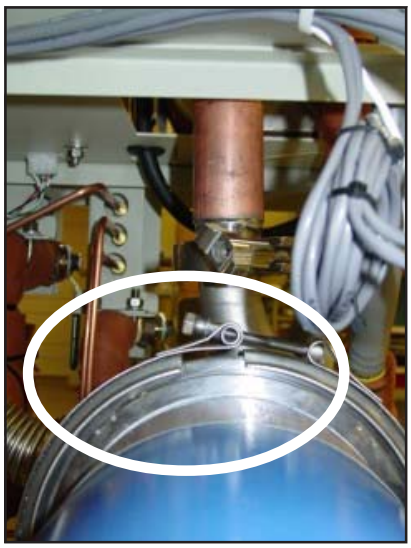
8. Remove the pump and plate from the unit.

CAUTION **The pump weighs at least 80 pounds.**

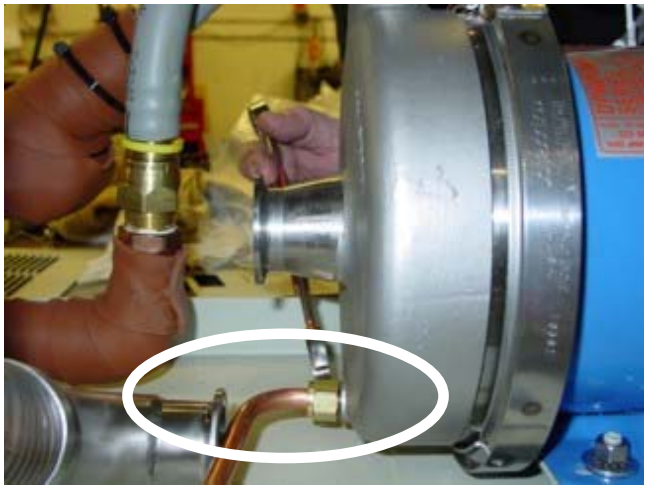
9. Using a 1/2" wrench, remove the nuts and washers securing the pump to the pump plate.

10. When reinstalling a new pump do not tighten any of the nuts, bolts, or clamps until all plumbing lines are properly aligned. Also, use new gaskets when reinstalling the sanitary clamps.

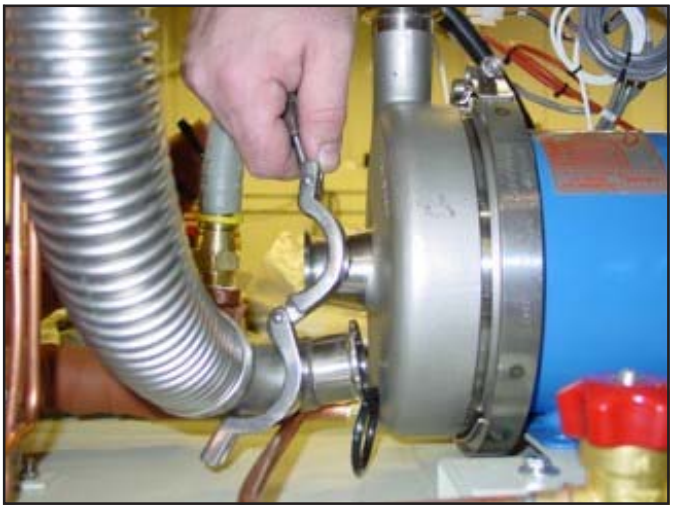
11. First correct pump discharge line to pump and then the plate exchanger. Recheck the alignment.



12. Using a 11/16" wrench, install the fitting from the pump's drain line.



13. Install the sanitary clamp on the pump's suction line.



12. Tighten all connections.

Torque Pump to Pump Plate	100-110"-lbs
Torque Pump Plate to Case	75"-lbs
Torque Sanitary Fittings	25"-lbs

13. Reconnect all the wiring.

Torque Pump Motor Ground Wires (3)	24 - 28"-lbs

14. Reinstall the control box assembly, see page 42.

15. Once the unit is restarted check for leaks.

16. Return the replaced pump to Thermo Electron.

Temperature Control Valve Assembly (360-900-12)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
1 3/4" wrench

Two 1 1/4" wrenches

Copper tubing cutting tool

Tywrap cutter/scissors

Tape, Insulating

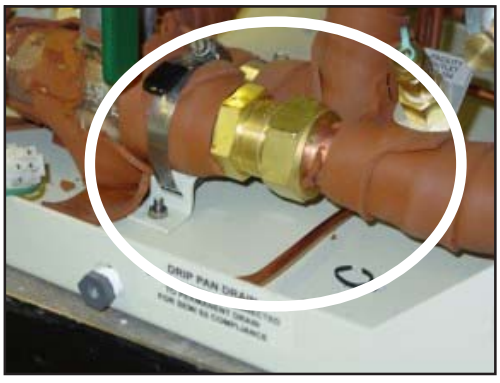
Procedure:

For easier access to the valve remove the unit from the cabinet.

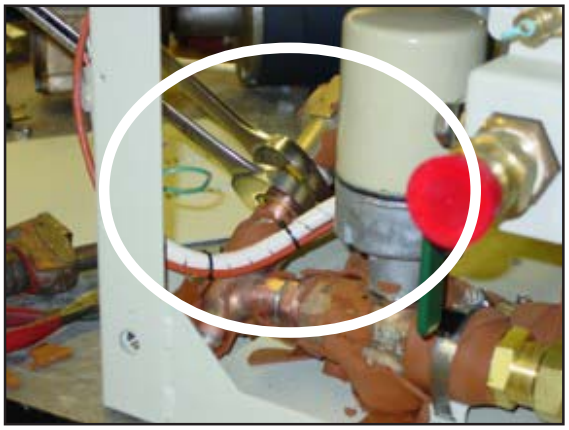
1. Drain the water. Refer to Teradyne Service Documentation for proper procedure.

2. Remove the insulation around the valve.

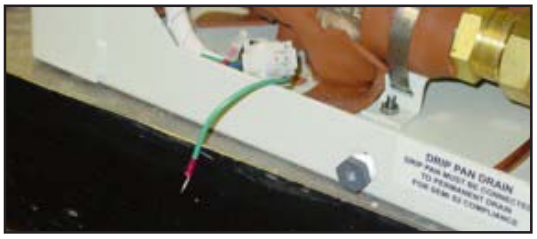
3. Use a 1 3/4" wrench to disconnect the right Swagelok.



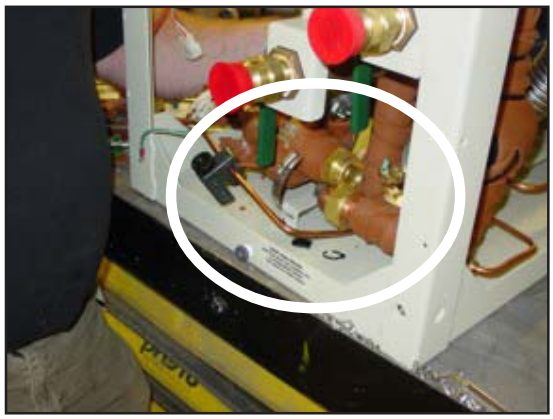
4. Use two 1 1/4" wrenches to disconnect the motor valve assembly from the Swagelok just below the unit's flow transducer.



5. Unplug the 6-pin connector and disconnect the ground wire.



6. Open the clamp securing the valve to the unit.



7. Cut the line in front of the valve in order to remove it from the unit.
   NOTE: On units with a union. Disconnect the union to remove the valve.

8. To reinstall a new valve first connect the 1 3/4" Swagelok - finger tight.

9. Connect the left Swagelok just below the flow transducer.

10. Install the clamp.

11. Install/reinstall a union on the cut line.

12. Tighten all connection. Refer to the Swagelok Installation on page 90.

Torque clamp	50"-lbs.

13. Reinstall the 6-pin connector and the ground wire.

Torque ground wire	24 - 28"-lbs.

14. Once the unit is restarted check for leaks.

15. Ensure the LED and error message on the controller are both extinguished.

16. Install insulation.

Temperature Control Valve Assembly (360-900-53)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
1 3/4" wrench

Two 1 1/4" wrenches

Copper tubing cutting tool

Tywrap cutter/scissors

Tape, Insulating

Procedure:

For easier access to the valve remove the unit from the cabinet.

1. Drain the water. Refer to Teradyne Service Documentation for proper procedure.

2. Remove the insulation around the valve.

3. Use a 1 3/4" wrench to disconnect the Swageloks.

4. Unplug the 6-pin connector and disconnect the ground wire.

5. Open the clamp securing the valve to the unit.

6. To reinstall a new valve first connect the 1 3/4" Swageloks - finger tight.

7. Install the clamp.

8. Tighten the two Swageloiks. Refer to the Swagelok Installation on page 88.

Torque clamp	50"-lbs.

9. Reinstall the 6-pin connector and the ground wire.

Torque ground wire	24 - 28"-lbs.

10. Once the unit is restarted check for leaks.

11. Ensure the LED and error message on the controller are both extinguished.

12. Install insulation.

Temperature Control Valve Actuator (360-900-13)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
1 5/8" wrench

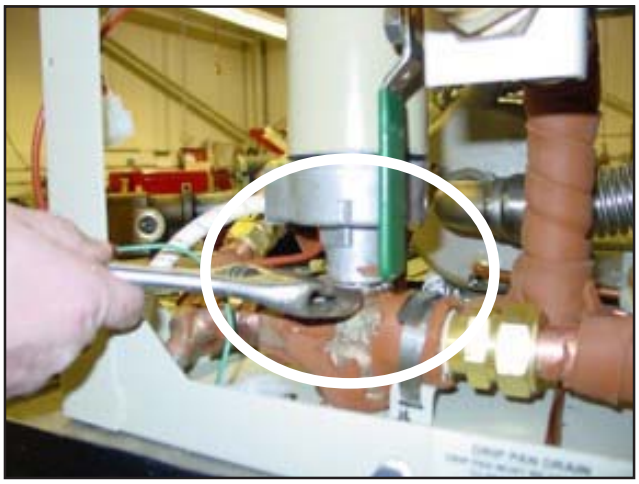
Tape, Insulating

Procedure:

For easier access to the actuator remove the unit from the cabinet.

1. Drain the water. Refer to Teradyne Service Documentation for proper procedure.

2. Use the 1 5/8" wrench to disconnect the actuator from the valve.



3. Unplug the 6-pin connector and disconnect the ground wire.

4. Reverse the procedure to install the actuator. Torque actuator to 20-25"-lbs.

5. Once the unit is restarted check for leaks.

6. Install insulation.

Water Flow Transducer (360-900-09/360-900-51)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
Adjustable wrenches

Teflon Sealant (FasSeal-ATS™)

Insulating Tape

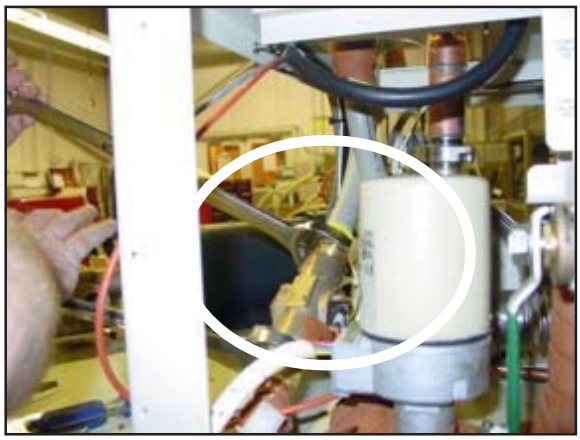
Procedure:

For easier access to the assembly remove the unit from the cabinet.

1. Drain the water. Refer to Teradyne Service Documentation for proper procedure.

2. Remove the insulation.

3. Use a wrench to hold the bottom fitting in place and a second wrench to undo the top hose.



4. Remove the bottom Swagelok.

5. Unplug the wiring from under the controller box.

6 The new flow transducer can be installed in either direction.

7. Connect both fittings, hand tight. **NOTE:** Use supplied thread sealant on upper connection.

8. Tighten the fittings, refer to the Swagelok Installation Sheet on page 90.

9. Connect the wiring to the control box.

10. Once the unit is restarted check for leaks.

11. Ensure the LED and error message on the controller are both extinguished.

12. Install insulation.

HFE Temp Sensor (rtd1)
(360-900-20/360-900-55)

Tools Required:

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

1/2" wrench

Tywrap cutters/Scissors

Procedure:

1. Use the 1/2" wrench to disconnect the sensor.

2. Slide the sensor down and through the unit's midpan.

3. Unplug the sensor from below the control box.

4. Reverse procedure to install new sensor. Refer to the Swagelok Installation Sheet on pages 90.

5. Once the unit is restarted check for leaks.

Pressure Transducers (360-900-16)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
5/8" wrench

Tywrap cutters/Scissors

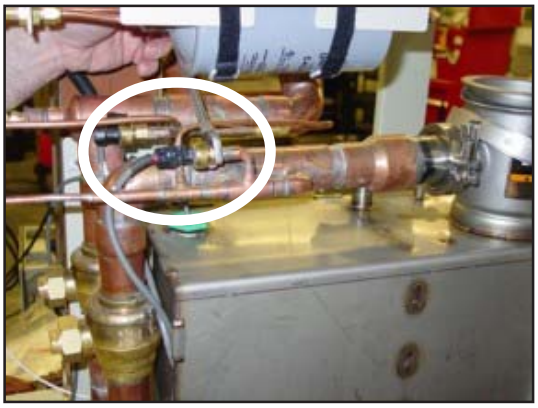
Procedure:

1. Unsnap the black plastic cap(s) on the transducer(s).

2. Use the 5/8" wrench to disconnect the transducer(s).

3. Unplug the wiring.

4. Reverse the procedure to install a new transducer. To tighten the fittings, refer to the Swagelok Installation Sheet on pages 90.



5. Once the unit is restarted check for leaks.

Drip Pan Level Switch Kit (360-900-17/360-900-54)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
3/8" wrench

Tywrap cutters/Scissors

Procedure:

1. Remove the 3/8" nut securing the kit to its bracket.

2. Undo wiring from below the control box.

3. To reinstall, reverse the procedure.

Pressure Regulator (360-900-08)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
Two 2 1/16" wrenches or adjustable wrenches

1/8" diameter test probe (Peterson Equip. Co. Inc. #500 Gauge Adapter or equivalent).

Insulating Tape

Procedure:

For easier access to the assembly remove the unit from the cabinet.

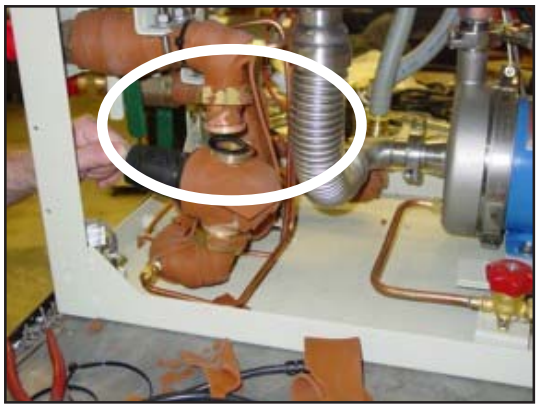
1. Drain the water. Refer to Teradyne Service Documentation for proper procedure.

2. Remove insulation around the regulator.

3. Loosen top union fitting.

4. Undo bottom union fitting.

5. Undo top union fitting.



6. When installing new regulator and washers ensure the arrow on the side of the regulator points down.

7. Install both unions, hand tight.

8. Tighten both unions, one full turn past hand tight.

9. Install new insulation.

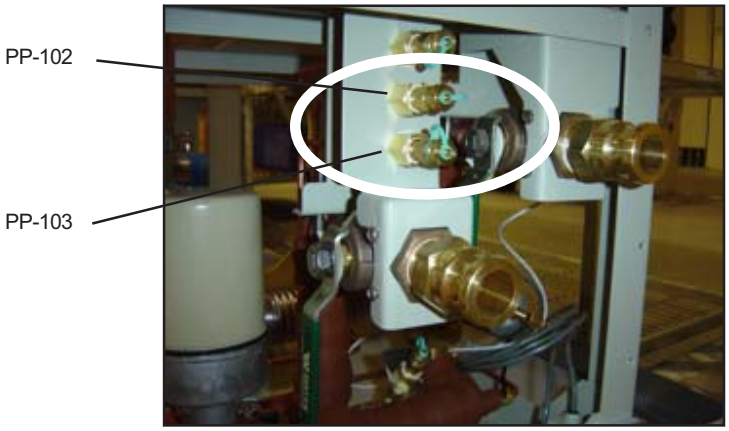
10. Once the unit is restarted check for leaks.

11. Ensure the LED and error message on the controller are both extinguished.

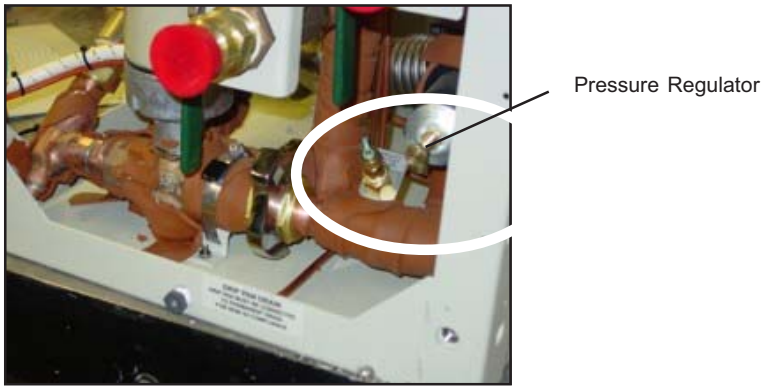
12. Adjust the pressure differential, see next page.

Using the test probe, verify the differential pressure across the temperature control valve using the two pressure test ports (Petes Plugs) PP-102 and PP-103.

With the unit off and facility water on, measure the pressure at PP-102. The pressure should match the facility water pressure. **NOTE:** If the pressure is 0 ensure that the facility water is on and that the facility supply valve is open. Next measure the pressure at PP-103. The difference between the two readings should be 30 - 33 PSI.



If adjustment is necessary loosen the locknut on the pressure regulator and then turn the adjustment bolt clockwise to increase the pressure, counter-clockwise to decrease the pressure. Tighten the locknut.



13. Install insulation.

Plumbing, Pressure Regulator to Temperature Control Valve (360-900-40360-900-59)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:

Two 2 1/16" wrenches or adjustable wrenches

One 1 3/4" wrench or adjustable wrench

Insulating Tape

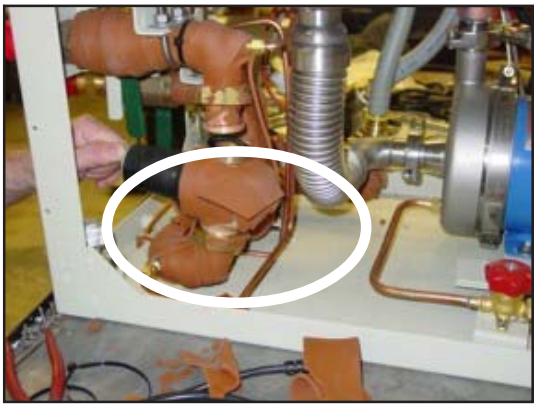
Procedure:

For easier access to the assembly remove the unit from the cabinet.

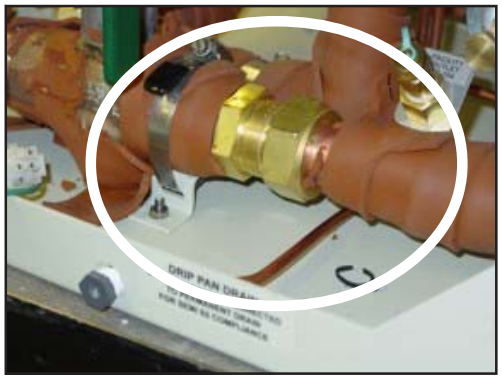
1. Drain the water. Refer to Teradyne Service Documentation for proper procedure.

2. Remove insulation around the connections.

3. Undo the bottom union fitting on pressure regulator.



4. Use a 1 3/4" wrench to disconnect the Swagelok.



5. To reinstall tighten union, one full turn past hand tight.

6. Tighten the fitting, refer to the Swagelok Installation Sheet on page 90.

7. Once the unit is restarted check for leaks then install insulation.

Facility Inlet Pipe (360-900-11/360-900-52)

WARNING

Turn off and Lockout/Tagout (LOTO) power before servicing.

Tools Required:
Two 2 1/16" wrenches or adjustable wrenches

One 1 3/4" wrench or adjustable wrench

Insulating Tape

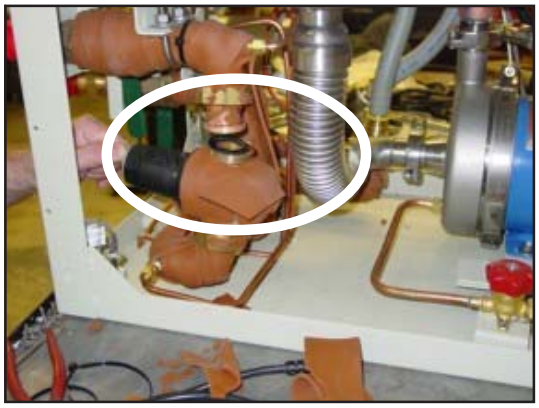
Procedure:

For easier access to the assembly remove the unit from the cabinet.

1. Drain the water. Refer to Teradyne Service Documentation for proper procedure.

2. Remove insulation.

3. Undo top union fitting on pressure regulator.



4. Undo the u-bolts securing the plumbing to the bottom of the unit's midpan.

5. To reinstall, reverse the procedure.

6. Tighten u-bolts until split washers on both sides are flat.

7. Once the unit is restarted check for leaks then install insulation.

H2O Side Temperature Sensor (rtd2) (360-900-18)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
Tywrap cutters/Scissors

Insulating Tape

Procedure:

1. Remove the control box assembly, see page 42.

2. Remove the insulation covering the sensor.

3. Cut the aluminum tape securing the sensor to the facility line.

4. Undo the wiring from below the control box.

5. Attach new sensor with hose clamp.

6. Install new tape and insulation.

7. Connect wiring.

8. Ensure the LED and error message on the controller are both extinguished.

9. Install insulation.

Return Pipe Assembly, Process Flow (360-900-00)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:

One 1/2" wrench or adjustable wrench

One 9/16" wrench or adjustable wrench

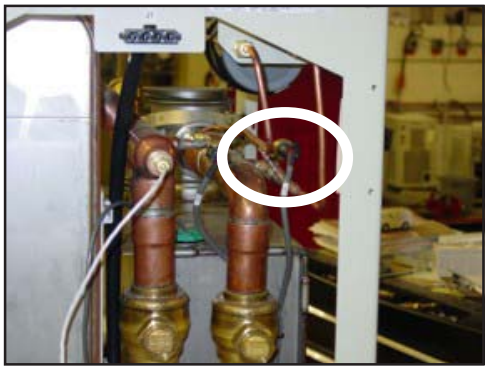
One 5/8" wrench or adjustable wrench

Procedure:

1. Drain the HFE. Refer to Teradyne Service Documentation for proper procedure.

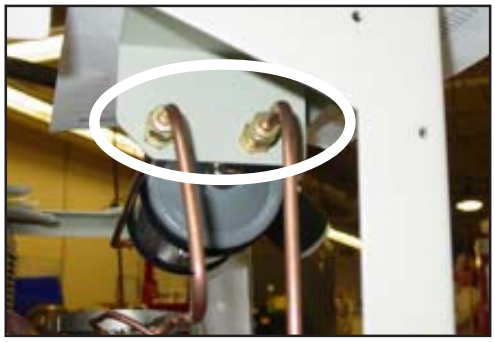
2. Unsnap the black plastic cap on the transducer

3. Use the 5/8" wrench to disconnect the transducer.



4. Use the 1/2" and 9/16" wrenchs to disconnect the two process flow lines.

5. Use the 1/2" wrench to disconnect the process lines from the dryer.



6. Undo the u-bolts securing the line to the unit.

7. Undo the sanitary fitting at the tank.

8. Reverse the procedure to install a new line. Tighten all connection. Refer to the Swagelok Installation on page 90.

Sanitary Fitting	25"-lbs.
U-bolts	Hand tighten and 3 turns

9. Once the unit is restarted check for leaks.

Supply Pipe Assembly, Process Flow (360-900-06/360-900-50)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:

One 1/2" wrench or adjustable wrench

One 9/16" wrench or adjustable wrench

One 5/8" wrench or adjustable wrench

Procedure:

1. Drain the HFE. Refer to Teradyne Service Documentation for proper procedure.

2.Unsnap the black plastic cap on the transducer

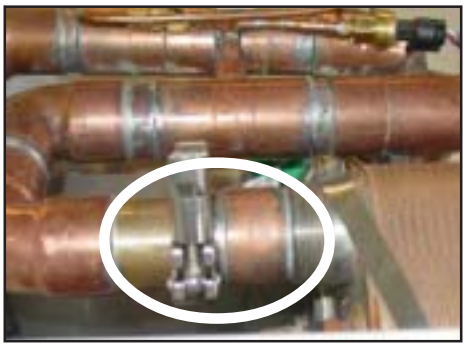
3. Use the 5/8" wrench to disconnect the transducer.

4. Use the 1/2" wrench to disconnect the temperature sensor.

5. Use the 1/2" and 9/16" wrenchs to disconnect the two process flow lines.

6. Undo the u-bolts securing the line to the unit.

7. Undo the sanitary fitting at the heat exchanger.



8. Reverse the procedure to install a new line. Tighten all connection. Refer to the Swagelok Installation on page 90.

Sanitary Fitting	25"-lbs.
U-bolts	Hand tighten and 3 turns

9. Once the unit is restarted check for leaks.

PRV Cartridge (360-900-41)

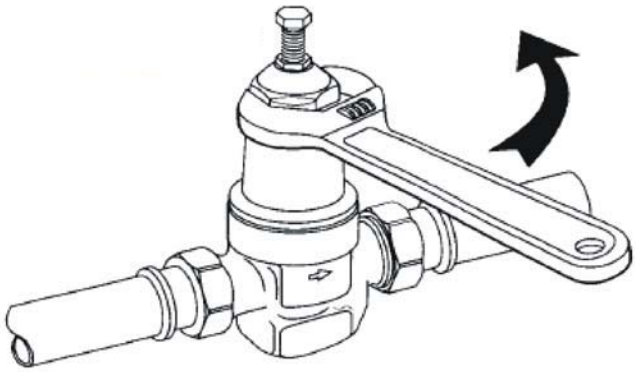
Tools Required:
Adjustable wrench

Two screwdrivers

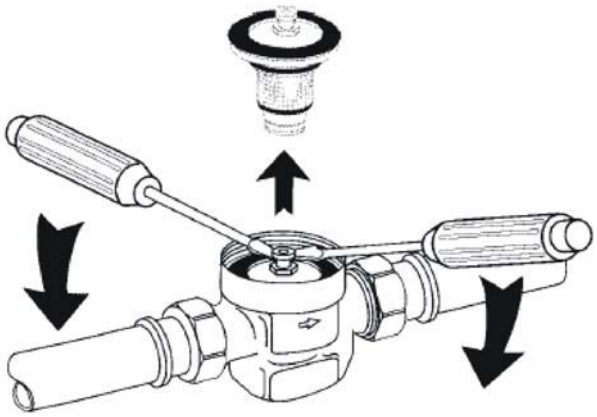
Procedure:

1. Loosen locknut and turn adjusting screw counterclockwise to remove the spring tension.

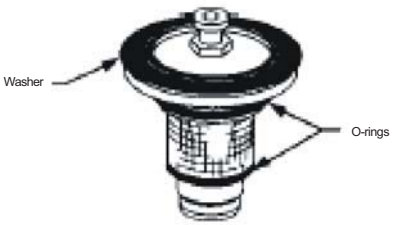
2. Remove the bonnet using the adjustable wrench.



3. Remove the cartridge using two screwdrivers as levers.



4. When installing new cartridge ensure the o-rings and washers are properly installed.



VFD Filter (360-900-30)
Contactor (360-900-25)
Transformer(360-900-26)

WARNING

Turn off and Lockout/Tagout (LOTO) power before servicing.

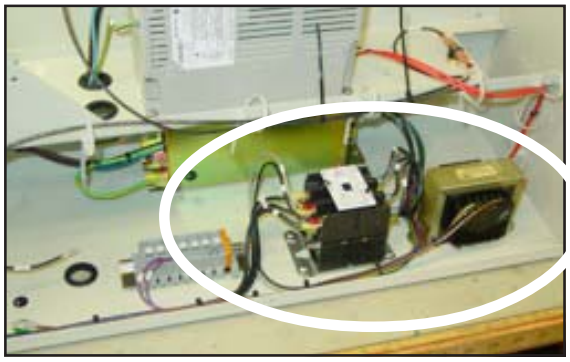
Tools Required:
McMaster Carr 8554A26, or equivalent torque screw driver

Wiring Diagram

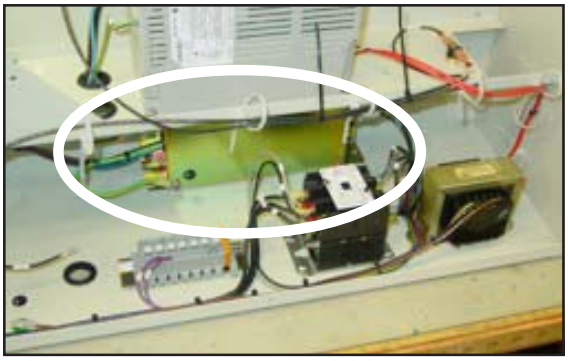
Procedure:

1. Remove the control box assembly, see page 42.

2. Remove wiring and screws from transformer and contactor to access the RFI.



3. Remove wiring and screws securing RFI to the unit.



4 To reinstall components, reverse the procedure.

Torque Transformer Mounting Screws	14 - 16"-lbs
Torque Contactor/RFI Mounting Screws	24 - 28"-lbs

5. Reconnect wiring, refer to wiring diagram.

Torque RFI Wiring	15½"-lbs
Torque RFI Ground Wire	22 - 26"-lbs
Torque RFI Filter Wires to Contactor	25"-lbs

6. Ensure the LED and error message on the controller are both extinguished.

EMO Thermostat (360-900-31)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
#6 Wrench or adjustable wrench

Loctite® threadlocker or equivalent

Procedure:

1. Remove the control box assembly, see page 42.

2. Remove the control box assembly side panel.

3. Locate the thermostat and remove the wiring and #6 nut.

4. To reinstall reverse the procedure. Hand-tight nut and secure with Loctite®.

Var Freq Drive VFD (360-900-27)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

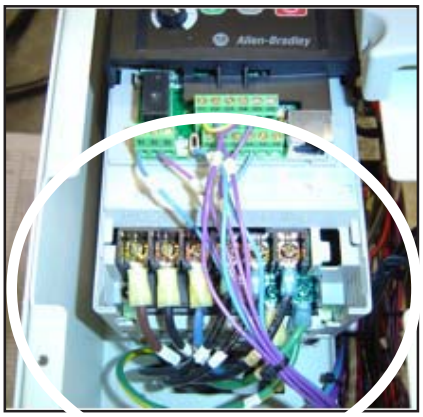
Tools Required:
McMaster Carr 8554A26, or equivalent torque screw driver

Wiring Diagram

Procedure:

1. Remove the control box assembly, see page 42.

2. Remove all wiring to the VFD.



3. Loosen the bottom two screws securing the VFD to the unit.

4. Remove the top two screws securing the VFD to the unit.

5. Slide new VFD into the bottom screws.

6. Install the top screws.

7. Torque all four screws to 24 - 28"-lbs.

8. Reconnect all wiring. Refer to wiring diagram.

Torque VFD Wire Connection Screws	16 - 19"-lbs
Torque VFD Ground Nut	14 - 16"-lbs
Torque VFD Signal Wires	4.4 - 7"-lbs
Torque VFD Jumper Wires	4.4 - 7"-lbs
Torque VFD Power Wires	16 - 19"-lbs
Torque VFD Controller Panel	10 - 12"-lbs

9. Calibrate the VFD and install default settings, see next page.

10. Check for error codes on the VFD and controller.

VFD Settings

Viewing and Editing Parameter Steps.

1. When Power is applied, the last user-selected Display Group parameter number is briefly displayed with flashing characters. The display then defaults to that parameter's current value.

2. Press Esc once to display the Display Group parameter number shown on power-up. The parameter number will flash.

3. Press Esc again to enter the group menu. The group menu letter will flash.

4. Press the Up Arrow or Down Arrow to scroll through the group menu (d, P and A).

5. Press Enter or Sel to enter a group. The right digit of the last viewed parameter in that group will flash.

6. Press the Up Arrow or Down Arrow to scroll through the parameters that are in the group.

7. Press Enter or Sel to view the value of a parameter. If you do not want to edit the value, press Esc to return to the parameter number.

8. Press Enter or Sel to enter program mode to edit the parameter value. The right digit will flash and the Program LED will illuminate if the parameter can be edited.

9. Press the Up Arrow or Down Arrow to change the parameter value. If desired, press Sel to move digit to digit or bit to bit. The digit or bit that you can change will flash.

10. Press Esc to cancel a change. The digit will stop flashing, the previous value is restored and the Program LED will turn off.
    Or
    Press Enter to save a change. The digit will stop flashing and the Program LED will turn off.

11. Press Esc to return to the parameter list. Continue to press Esc to back out of the programming menu. If pressing Esc does not change the display, then d001 [Output Frequency] is displayed. Press Enter or Sel to enter the group menu.

Settings

Display Group and Number	Setting
P031	208
P033	14.7
P036	2
P038	2
A051	7
A052	5

Circuit Breaker (360-900-24)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
McMaster Carr 8554A26, or equivalent torque screw driver

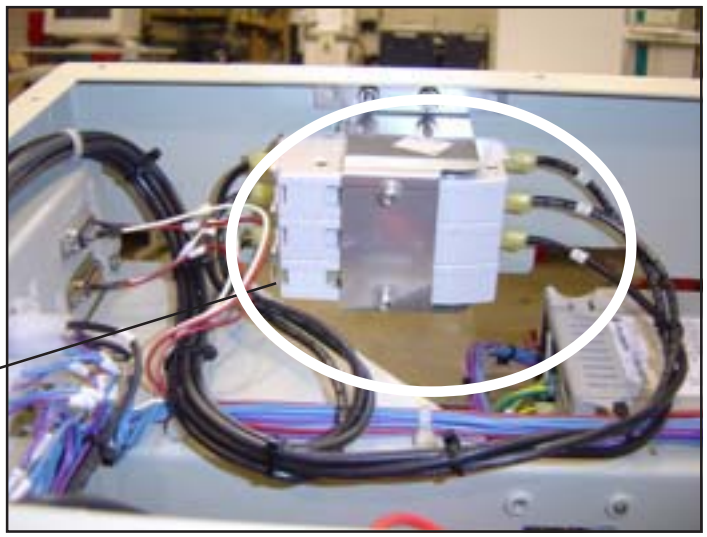
Wiring Diagram

Procedure:

1. Remove the control box assembly, see page 42.

2. Remove the four nuts securing the circuit breaker to the unit.

3. Remove all wiring to the circuit breaker.



4. Press the spring on the circuit breaker to separate it from the bracket.

5. To reinstall, reverse the procedure.

Torque Circuit Breaker 11/32 Mounting Nuts	14 - 16"-lbs

6. Reinstall wiring, refer to wiring diagram.

Torque Circuit Breaker Wire Connections	20"-lbs

Temp Option Board (TC-400 to LON Adapter) (360-900-29)

WARNING

Turn off and Lockout/Tagout (LOTO) power before servicing.

WARNING

Use proper ESD (Electro Static Discharge) procedures when handling the chip and controller. Typically a grounded wrist strap is used to ground the individual so static discharge is released prior to and during handling.

Tools Required:
Small pair of needle nose pliers

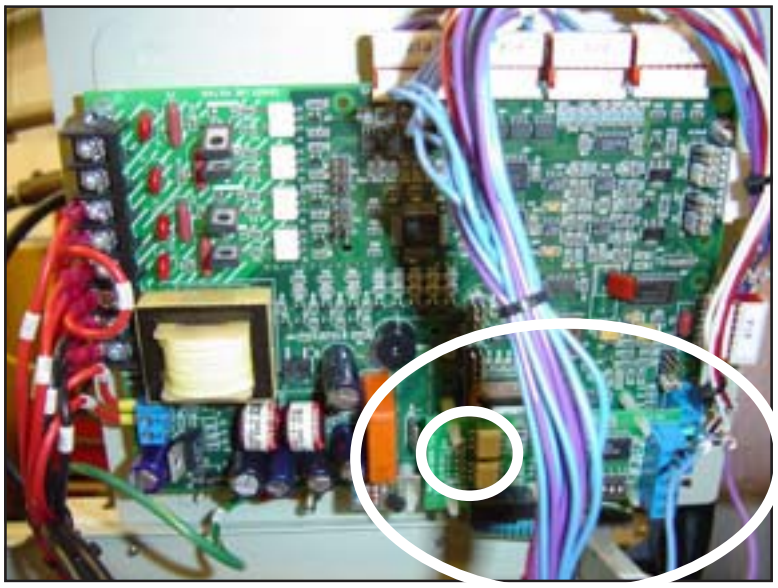
Wiring Diagram

Procedure:

1. Remove the control box assembly, see page 42.

2. Remove wiring

3. Using the pliers, press the "ears" on the four corners of the board and pull it out.



4. Snap new board back into position.

5. Install wiring, refer to wiring diagram.

6. Ensure the LED and error message on the controller are both extinguished.

Chip Replacement (390-900-39)

WARNING

Turn off and Lockout/Tagout (LOTO) power before servicing.

WARNING

Use proper ESD (Electro Static Discharge) procedures when handling the chip and controller. Typically a grounded wrist strap is used to ground the individual so static discharge is released prior to and during handling.

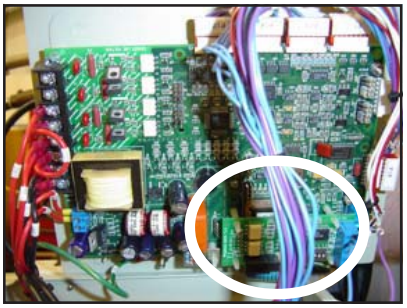
Tools Required

Plastic Leaded Chip Carrier (PLCC) extraction tool (not supplied) or equivalent.

Procedure

1. Remove control box assembly, see page 42.

2. The chip is located on the TC-400 Control Board, beneath the Communications Board. Remove the Communications Board.



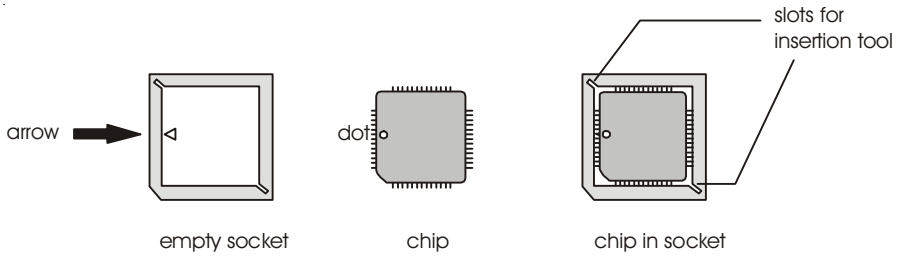
3. Remove old programmed chip with the PLCC extraction tool. If one is not available a suitable tool is available from Thermo under part number 082166. Additional instructions are provided with the tool.

4. Insert new programmed chip by placing the chip over the socket with the orientation dot on the chip aligned with the orientation arrow on the board. Note that sometimes dot may be covered by a label, see below. Do not rely on the chip label since its orientation can be random. You may also notice that a corner of the chip and socket are slightly flattened. Press chip onto the socket by applying equal pressure to the chip until the chip completely snaps into the socket.

5. Replace the Communications Board and the control box assembly.

6. Start the unit and skip through any error messages using the controller's NEXT key. (Error 3 may appear when the new chip is powered up for the first time.)

7. Unit must be recalibrated for proper operation. Refer to Teradyne Service Documentation for proper procedure.



TC-400 Control Board
(360-900-38)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

WARNING **Use proper ESD (Electro Static Discharge) procedures when handling the chip and controller.** Typically a grounded wrist strap is used to ground the individual so static discharge is released prior to and during handling.

Tools Required:
Small pair of needle nose pliers

Screwdriver

Phillips Screwdriver

¼" Nut driver

Plastic Leaded Chip Carrier (PLCC) extraction tool (not supplied) or equivalent.

Wiring Diagram

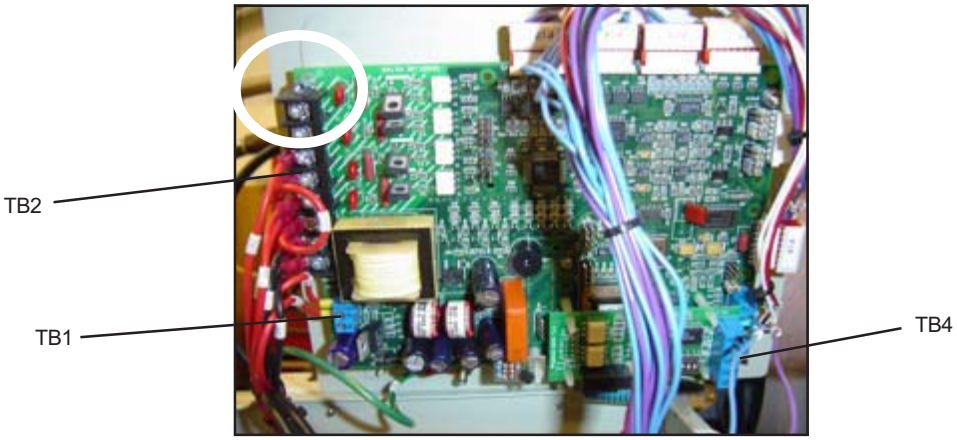
Procedure:

1. To allow the panel to fold down, remove the 4 screws securing the keypad panel to the front of the unit.

2. Remove all wiring to the board.

3. Remove the Temp Option Board and Programmable Chip, see previous two pages.

4. Undo the four corner mounting nuts securing the board to the unit.



5. To reinstall, reverse the procedure. Refer to wiring diagram. **NOTE:** Ensure jumper settings on new board match the settings on the wiring diagram.

Torque mounting nuts	6 - 8"-lbs
Torque 1TB/2TB Wires	8 -10"-lbs
Torque 4TB Wires	4.4 - 7"-lbs

6. Calibrate the new board. Refer to Teradyne Service Documentation for proper procedure.

7. Ensure the error message on the controller is extinguished.

LON Adapter Board (360-900-28)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

WARNING **Use proper ESD (Electro Static Discharge) procedures when handling the chip and controller.** Typically a grounded wrist strap is used to ground the individual so static discharge is released prior to and during handling.

Tools Required:
Small pair of needle nose pliers

Wiring Diagram

Procedure:

1. Remove the SMC Rider Board.

2. Remove the wiring to the LON.

3. Press the "ears" on all four corners of the board and pull it out.

4. To reinstall, reverse the procedure. Refer to wiring diagram.

5. Install the SMC Rider Board.

6. Calibrate the new board. Refer to Teradyne Service Documentation for proper procedure.

7. Ensure the LED and error message on the controller are both extinguished.

Sight Tube Kit
(360-966-15)

WARNING **Turn off and Lockout/Tagout (LOTO) power before servicing.**

Tools Required:
11/16" wrenche or adjustable wrenche

5/8" wrenche or adjustable wrenche

Procedure:

1. Remove the old sight tube by loosening and removing the 2 swaglock elbows from tank stub tubes using an 11/16 and 5/8 wrench.

2. To assemble the new tube you need to remove one side of each new swagelock elbow. The other side of the elbow you need to take apart and reassemble as follows.

a. Slide the nut portion on the tube with the threads facing the ends of the tube.

b. Install the brass back ferrule on next with the wider part on first.

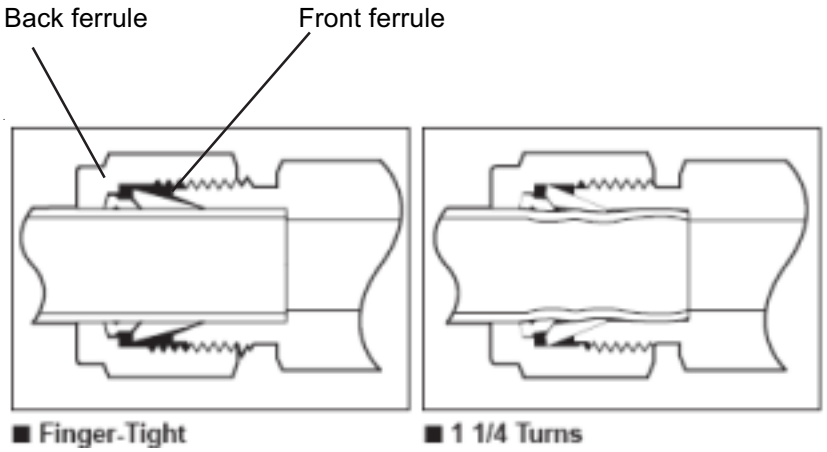
c. Install the **TEFLON** front ferrule next with the larger end going on first. Note you are not using the brass front ferrule on the tube you are replacing it with the Teflon one. See drawing below for an example.

d. Install brass insert into each end of tube.

e. Assemble the elbow pieces to each end of the tube until they are hand tight.

f. Slide the other end of the elbows onto the tank stub tubes and tighten finger tight. With the wrenches hold the elbows straight and tighten the nut about and 1/8 of a turn no more than a ¼ of a turn.

g. Tighten the nuts on the tube side 1 ¼ turns from hand tight.



Torque Specification Sheet

Mechanical Assemblies

Pump Plate to Case	75"-lbs
Pump to Pump Plate	100-110"-lbs
Hose Clamps	50"-lbs
Unions (Pressure Regulator)	One full turn past hand tight
CAM Lock Fittings	70'-lbs
Sanitary Fittings	25"-lbs
Facility Water Outlet Assembly	75"-lbs
Process side U-bolts ¼-20 (084302)	Hand tighten and then 3 turns
Facility side U-bolts 3/8-16 (084292)	Hand tighten until split washers are flat on both sides
Temperature control valve actuator	20-25"-lbs
Sight tube kit	Hand tighten and then 1 1/4 turns

Electrical Assemblies

For phillips head screws we recommend using a McMaster Carr 8554A26, or equivalent

Float Switch	Hand tight
Motor Valve Ground Wire	24 - 28"-lbs
Pump Motor Ground Wires (3)	24 - 28"-lbs
Control Box Assembly to Mid Pan, Bottom	14 - 16"-lbs
Control Box Assembly to Mid Pan, Top	24 - 28"-lbs
Control Box Assembly to Sides	24 - 28"-lbs
Contactor Connecting Screws	25"-lbs
VFD Mounting Screws	24 - 28"-lbs
VFD Wire Connection Screws	16 - 19"-lbs
VFD Ground Nut	14 - 16"-lbs
VFD Signal Wires	4.4 - 7"-lbs
VFD Jumper Wires	4.4 - 7"-lbs
VFD Power Wires	16 - 19"-lbs
VFD Controller Panel	10 - 12"-lbs
Control Board Mounting #4 Nuts	6- 8"-lbs
1TB Wires	8 -10"-lbs
2TB Wires	8 -10"-lbs
4TB Wires	4.4 - 7"-lbs
Key Pad Ground 11/32 Nut	14 - 16"-lbs
RFI Filter Wires to Contactor	25"-lbs
RFI Filter Mounting Screws	24 - 28"-lbs
RFI Wiring	15½"-lbs
RFI Ground Wire	22 - 26"-lbs
Transformer Mounting Screws (8 - 32 x 1/4")	14 - 16"-lbs
Contactor Mounting Screws (10 - 32 x 3/8")	24 - 28"-lbs
Circuit Breaker 11/32 Mounting Nuts	14 - 16"-lbs
Circuit Breaker Wire Connections	20"-lbs

Swagelok Tube Fitting Instructions[1]

Installation

1. Insert tubing into the Swagelok tube fitting.

2. Make sure that the tubing rests firmly on the shoulder of the tube fitting body and that the nut is finger-tight.

3. Scribe the nut at the 6 o'clock position.

4. While holding fitting body steady, tighten the nut 11/4 turns to the 9 o'clock position. Note: For **1/16, 1/8,** and **3/16 in; 2, 3,** and **4 mm** tube fittings, tighten the nut 3/4 turn to the 3 o'clock position.

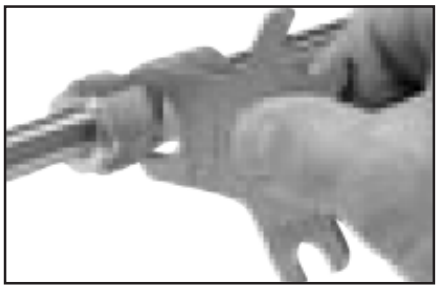
Installation in High-Pressure Applications and High Safety-Factor Systems

1. Follow steps 1 and 2 of the Swagelok Tube Fitting Instructions.

2. Tighten the nut until the tubing will not rotate freely by hand.

3. Follow steps 3 and 4 of the Swagelok Tube Fitting Instructions.

Gageability — On initial installation, the Swagelok gap inspection gauge assures the installer or inspector that a fitting has been sufficiently tightened.



Position the Swagelok gap inspection gauge next to the gap between the nut and body.

• If the gauge will not enter the gap, the fitting is sufficiently tightened.

• If the gauge will enter the gap, additional tightening is required.

Reassembly Instructions — You may disassemble and reassemble a

Swagelok tube fitting, port connector, cap, and plug many times.

1. Insert tubing with pre-swaged ferrules into the fitting body until the front ferrule seats.

2. Rotate the nut with a wrench to the previously pulled-up position. At this point, a significant increase in resistance will be encountered.

3. Tighten slightly with a wrench. Note: Do not use the gap inspection gauge with reassembled fittings.

Do not mix or interchange parts with those of other manufacturers.

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1. Swagelok Pocket Catalog of Tube Fittings MS-13-58

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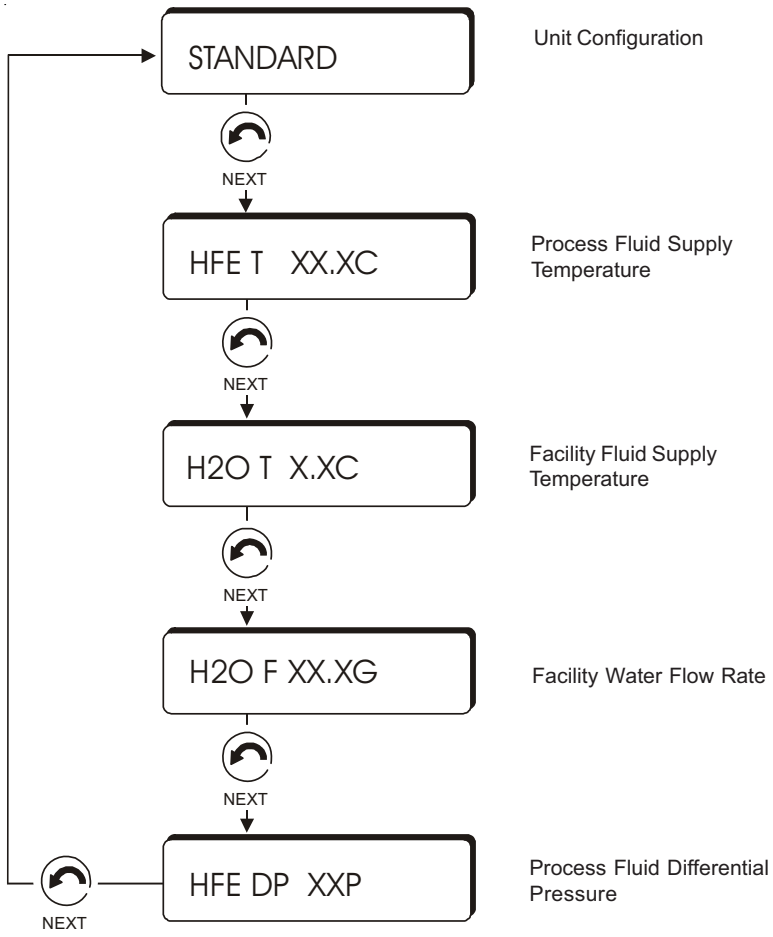
Main Loop

An alphanumeric display presents numeric readings of various operating conditions within the chiller. Display function is selected by pressing the appropriate keys to move through a menu of available information.

Main Loop

When the controller is first powered up it goes through a short self-test, and then enters the Main Loop and displays the unit configuration.

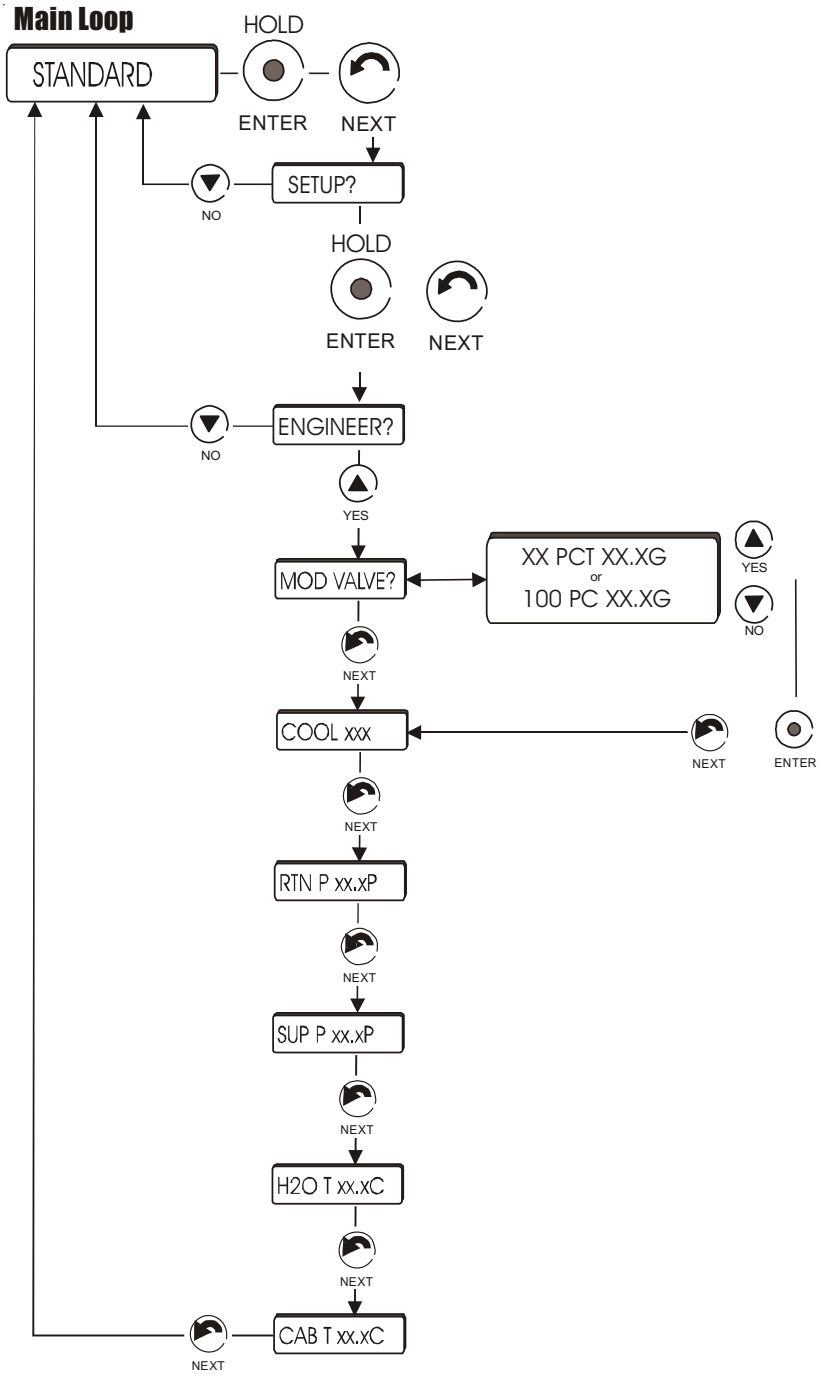


Main Loop

Engineering Loop

The Engineering Loop allows you to open or close the temperature control valve. Use the **YES** button to enter the valve condition. The display will then flash between the position of the valve and the facility flow value. Use the **YES** or the **NO** buttons to open or close it in 10% increments. When the desired value is displayed press **ENTER** and then **NEXT** to sequence through the displays.

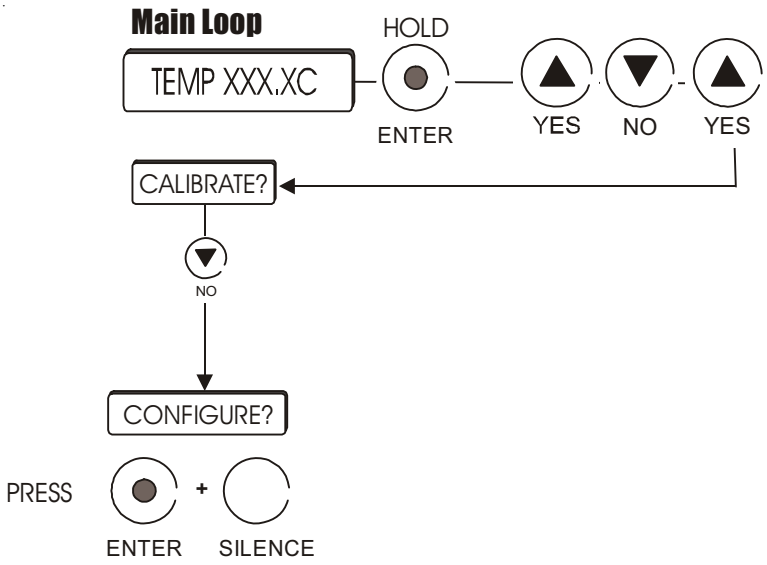
Press **NEXT** to sequence the display through the cool duty cycle, the coolant return pressure, the coolant supply pressure, the facility water temperature, and the ambient air temperature. Press **NEXT** again to return to the Main Loop.



Engineering Loop

Factory Reset

A Factory Reset returns all the controller settings to its factory preset values.



After the Reset a controlller calibration is required. Refer to Teradyne Service Documentation for proper procedure.

WARRANTY

Thermo Electron Corporation warrants for 24 months from date of shipment any Thermo Electron unit according to the following terms.

Any part of the CDU manufactured or supplied by Thermo Electron and found in the reasonable judgment of Thermo Electron to be defective in material or workmanship will be repaired at an authorized Thermo Electron Repair Depot without charge for parts or labor. The CDU, including any defective part must be returned to an authorized Thermo Electron Repair Depot within the warranty period. The expense of returning the CDU to the authorized Thermo Electron Repair Depot for warranty service will be paid for by the buyer. Thermo Electron's responsibility in respect to warranty claims is limited to performing the required repairs or replacements, and no claim of breach of warranty shall be cause for cancellation or recision of the contract of sales of any CDU. With respect to CDUs that qualify for field service repairs, Thermo Electron's responsibility is limited to the component parts necessary for the repair and the labor that is required on site to perform the repair. Any travel labor or mileage charges are the financial responsibility of the buyer.

The buyer shall be responsible for any evaluation or warranty service call (including labor charges) if no defects are found with the Thermo Electron product.

This warranty does not cover any CDU that has been subject to misuse, neglect, or accident. This warranty does not apply to any damage to the CDU that is the result of improper installation or maintenance, or to any CDU that has been operated or maintained in any way contrary to the operating or maintenance instructions specified in Thermo Electron's Instruction and Operation Manual. This warranty does not cover any CDU that has been altered or modified so as to change its intended use.

In addition, this warranty does not extend to repairs made by the use of parts, accessories, or fluids which are either incompatible with the CDU or adversely affect its operation, performance, or durability.

Thermo Electron reserves the right to change or improve the design of any CDU without assuming any obligation to modify any CDU previously manufactured.

THE FOREGOING EXPRESS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Thermo Electron's OBLIGATION UNDER THIS WARRANTY IS STRICTLY AND EXCLUSIVELY LIMITED TO THE REPAIR OR REPLACEMENT OF DEFECTIVE COMPONENT PARTS AND Thermo Electron DOES NOT ASSUME OR AUTHORIZE ANYONE TO ASSUME FOR IT ANY OTHER OBLIGATION.

Thermo Electron ASSUMES NO RESPONSIBILITY FOR INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES INCLUDING, BUT NOT LIMITED TO LOSS OR DAMAGE TO PROPERTY, LOSS OF PROFITS OR REVENUE, LOSS OF THE UNIT, LOSS OF TIME, OR INCONVENIENCE.

This warranty applies to CDUs sold in the United States. Any CDUs sold elsewhere are warranted by the affiliated marketing company of Thermo Electron. This warranty and all matters arising pursuant to it shall be governed by the law of the State of New Hampshire, United States. All legal actions brought in relation hereto shall be filed in the appropriate state or federal courts in New Hampshire, unless waived by Thermo Electron.